Research Report
KTC-99-53

EVALUATION OF SUPERPAVE IN KENTUCKY

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16. Abstract

Approximately 93 percent of all pavements in the United States are surfaced with hot-mix asphalt (HMA). For many decades, most asphalt pavements were designed using the Marshall mix design method. In 1987, the Strategic Highway Research Program was established with 50 million dollars being allocated for asphalt pavement research. From that research, a new asphalt mix design procedure, called Superpave, was developed. Many states have adopted, or are in the process of adopting, this procedure, including Kentucky. In 1995, Kentucky placed its first Superpave mixture on KY 676 in Franklin County. In 1998, the Kentucky Transportation Cabinet requested that the Kentucky Transportation Center (KTC) evaluate the Superpave projects in Kentucky. The objectives of this study were as to develop a database of performance characteristics to assist in the development of prediction models for Superpave, to evaluate construction practices involving Superpave projects, and to attempt to perform a life-cycle cost analysis for Superpave projects.

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ABSTRACT

Approximately 93 percent of all pavements in the United States are surfaced with hot-mix asphalt (HMA). For many decades, most asphalt pavements were designed using the Marshall mix design method. In 1987, the Strategic Highway Research Program was established with 50 million dollars being allocated for asphalt pavement research. From that research, a new asphalt mix design procedure, called Superpave was developed. Many states have adopted, or are in the process of adopting, this procedure, including Kentucky. In 1995, Kentucky placed its first Superpave mixture on KY 676 in Franklin County. In 1998, the Kentucky Transportation Cabinet requested that the Kentucky Transportation Center (KTC) evaluate the Superpave projects in Kentucky. The objectives of this study were to develop a database of performance characteristics to assist in the development of prediction models for Superpave, to evaluate construction practices involving Superpave projects, and to attempt to perform a life-cycle cost analysis for Superpave projects.

The Superpave mixtures observed during this study were all designed on the coarse side of the restricted zone. No fine-graded mixtures were placed during the course of this study. Problems that were observed during construction included low VMA, low TSR, low density, dips, humps, aggregate and thermal segregation, tender zones, and trouble with establishing rolling patterns. The review of the national experience with Superpave indicates that most of these problems are also being observed nationwide.

The national survey recommended using heavier rollers to help with the compaction of Superpave mixtures. Data from this study indicated that less compactive effort was required when using two heavy rollers than when using three lighter-weight rollers. Contractors that used two heavy rollers were able to achieve the target density faster and avoid the tender zone (usually occurring between 170 and 280 °F). Information obtained during this study also indicated that mixtures were less likely to move if the underlying surface had been milled, or a leveling course had been placed, prior to the new overlay.

The use of material-transfer vehicles (MTV's) significantly reduced the amount of aggregate and thermal segregation. The degree of thermal segregation will likely increase with decreasing air temperatures. Further research is needed to evaluate the effects of thermal segregation on short and long-term performance of asphalt pavement.

Mixing temperatures for base mixtures ranged from as low as 300 °F for PG 64-22 binder to as high as 345 °F for PG 76-22 binder. The average lay-down temperature was 20 to 26 degrees lower than the mixing temperature. The rolling temperatures for the base mixtures ranged from as low as 280 °F for PG 64-22 binder to as high as 315 °F for the stiffer PG 70-22 and PG 76-22 binders. The working temperature range appeared to be larger for the softer binders.

The mixing temperatures for the surface mixtures (containing different grade binders) were considerably more variable than for the base mixtures. The lay-down temperatures ranged from as low as 275 °F to as high as 340 °F. The lay-down temperature was below the target temperature for three projects with PG 76-22 binder.

As expected, there was an inverse relationship between VMA and laboratory density. There was a slightly inverse relationship between VMA and core density. The core densities for the base mixtures

closely matched the laboratory densities. Most of the surfaces fell well below the line of equality. There appeared to be little relationship between asphalt binder content (AC) and core density.

Performance comparison between Superpave and Marshall mixtures indicates that Superpave mixtures appear to be performing better. The Marshall mixtures appear to be more prone to bleeding, rutting, and other surface distresses. However, more transverse cracking was noted on the Superpave projects than the on Marshall projects. Cost comparisons indicate that the Superpave mixtures cost about the same as the Marshall mixtures, and at this time, it appears that Superpave mixtures may last longer.

The initial ride index for Superpave and Marshall projects appear to be approximately the same.

The Superpave and Marshall projects observed in this study should be evaluated long-term so that long-term performance information may be collected.

1.0 INTRODUCTION

Approximately 93 percent of all pavements in the United States are surfaced with hot-mix asphalt (HMA). For many decades, most asphalt pavements were designed using the Marshall mix design method. In 1987, the Strategic Highway Research Program was established with 50 million dollars being allocated for asphalt pavement research. From that research, a new asphalt mix design procedure, called Superpave developed. Many states have adopted, or are in the process of adopting this procedure, including Kentucky. In 1995, Kentucky constructed its first Superpave mixture on KY 676 in Franklin County. In 1998, the Kentucky Transportation Cabinet requested that the Kentucky Transportation Center (KTC) evaluate the Superpave projects in Kentucky. The objectives of this study were to develop a database of performance characteristics to assist in the development of prediction models for Superpave, to evaluate construction practices involving Superpave projects, and to attempt to perform life-cycle cost analysis for Superpave projects.

2.0 A REVIEW OF NATIONAL EXPERIENCE WITH SUPERPAVE

To fully evaluate Superpave projects in Kentucky, it was determined that an overview of nationwide Superpave construction was needed. Published data and information from the "United States Hot Mix Asphalt Conference" was used in this review. The following paragraphs are a brief summary of that information.

The majority of Superpave mixtures in the country are being designed on the coarse side of the gradation band (going below the restricted zone).

Low VMA was the most widely reported problem occurring in the quality control of the mixture. Several states and contractors believe that rounding of the coarse aggregate in the dryer was affecting the VMA.

The industry reported that Superpave mixtures have a tendency to cool more quickly. It is believed that the mixtures are coarser and that the large aggregate may need to mix longer, in order to completely heat the larger aggregate. Another temperature-related problem reported was thermal segregation, which occurs when the outer surface of the mix cools more rapidly than the rest of the mix while in the truck. It appears that the outer surface (cool surface layer) slumps off first when the truck bed is raised, sending this cooler material through the paver first. This layer is cooler and harder to compact.

Better control of aggregate moisture in the stockpiles was recommended for more uniform mixtures. Several agencies are requiring the stockpile to be placed on paved surfaces to promote better drainage.

Separation of modifiers was reported during storage. The national trend is to use vertical storage tanks, making it easier to keep the modifiers from separating. Drain-down of the liquid asphalt has been observed in the coarser mixes. Drain-down can occur in the storage silo and with haul times greater than 20 minutes. Increased dust, fibers, and additives were recommended to help control drain-down.

The industry reported that Superpave mixtures typically can have a tender zone during compaction. Rubber-tired rollers were recommended for tender zones, but material pickup can be a problem. Tender zones are typically allowed to cool to a point were the mat is less tender. Tender mixes usually occur below 280 °F.

Nationwide, it appears that Superpave mixtures require more compactive effort than conventional mixtures. Industry recommendations on compaction are:

- larger rollers,
- more rollers,
- rollers closely spaced,
- rollers stay close to the paver.

Segregation of Superpave mixtures and conventional mixtures was noted by the industry. Data indicates that 70 to 75 percent of segregation occurs at the plant or in the truck, 25 percent occurs at the paver (in- line segregation), and one to three percent is random. Segregation was reported as early as the aggregate stockpiles.

3.0 CONSTRUCTION

In 1998, personnel from the KTC visited 24 Superpave projects that were under construction in order to evaluate the constructability of Superpave mixtures. A list of construction information that was gathered from each project is listed below (field data gathered from each site are contained in Appendix A and construction summaries are contained in Appendix B):

Mix Temperature
Lay-Down Temperature
Rolling Temperature
Rolling Pattern
Number of Rollers
Distance From Paver
Distance Between Rollers
Aggregate Breakage
Rutting
Shoving, Tracking, etc.
Segregation
Density
Paver Type
Time Between Trucks
Haul Distance
Placement Into Trucks (# of drops and location)
Base or Substrate
Mix Design Information

3.1 Construction Temperatures

3.1.1 Base Course

3.1.1.1 Mix Temperature

Three different PG binders were used in the base course mixtures. As expected, higher mixing temperatures were required for the higher viscosity binders. The average mix temperatures for the PG 64-22 binders ranged from 300 to 334 °F (results of four projects). The mixing temperature for the PG 70-22 binder was approximately 338 °F (result of one project). The highest mixing temperatures recorded were for the PG 76-22 binders with a range of 340 to 345 °F (results of two projects) (Figure 1). The vertical lines in that figure indicate the range of temperatures.

3.1.1.2 Lay-Down Temperature

The lay-down temperature for the base mixes was 20 to 26 degrees lower than the mixing temperature. Loss of temperature between the plant and the paver increased with the stiffer binders (Figure 1).

3.1.1.3 Rolling Temperature

The rolling temperatures for the base mixes ranged from as low as 280 °F for the PG 64-22 binders to as high as 315 °F for the stiffer PG 70-22 and PG 76-22 binders. The working temperature range appeared to be larger for the softer binders (Figure 1).

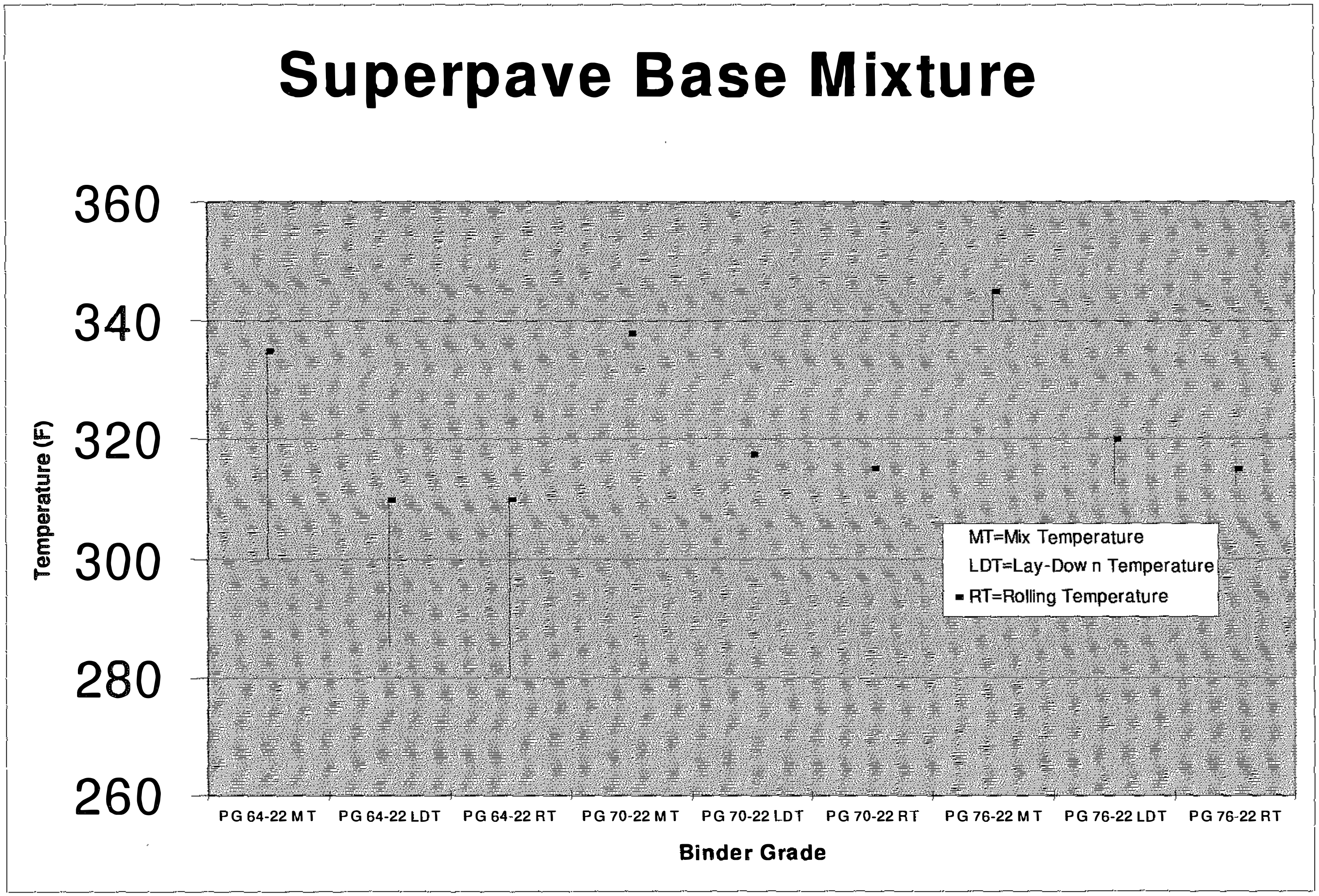

Figure 1. Mix, Lay-Down, and Rolling Temperatures for Superpave Base Mixtures.

3.1.2 Surface Course

3.1.2.1 Mix Temperature

The mixing temperature for the Superpave surface mixtures ranged from as low as 300 °F for the PG 64-22 binders to as high as 345 to 350 °F for the PG 70-28 and PG 76-22 binders (Figure 2). The mixing temperatures for the PG 64-22 binders ranged from 300 to 340 °F (results of eight projects), and the PG 70-22 ranged from 315 to 325 °F (results of two projects). The mixing temperatures for the PG 70-28 were 345 to 350 °F (results of two projects), and the PG76-22 were 325 to 345 °F (results of five projects). The mixing temperatures for the surface mixtures were considerably more variable than for the base mixtures.

3.1.2.2 Lay-Down Temperature

The average lay-down temperature for the Superpave surfaces ranged from as low as 275 °F to as high as 340 °F (Figure 2). The average temperature change from the plant to the lay-down operation was 23 °F for the PG 64-22 binder, 15.8 °F for the PG 70-22 binder, 45.3 °F for the PG 70-28 binder, and 18.3 °F for the PG 76-22 binder. Initial lay-down temperatures below the minimum target temperature of 302 °F were observed for the PG 76-22 binders (US 23 in Pike Co., KY 550 in Knott Co., and US 31W Jefferson Co.).

3.1.2.3 Rolling Temperature

Initial rolling temperatures ranged from as low as 267 °F for the PG 64-22 binders to as high as 345 °F for the PG 76-22 binders. Initial compaction temperatures of 268 °F were reported for the PG 70-22, 280 °F for the PG 70-28, and 280 °F for the PG 76-22 binder. Although the ranges overlap, it is interesting to note that the rolling temperatures for the PG 70-22 and the PG 70-28 tended to be lower than for the other binder grades. The reason for this occurrence is not immediately clear.

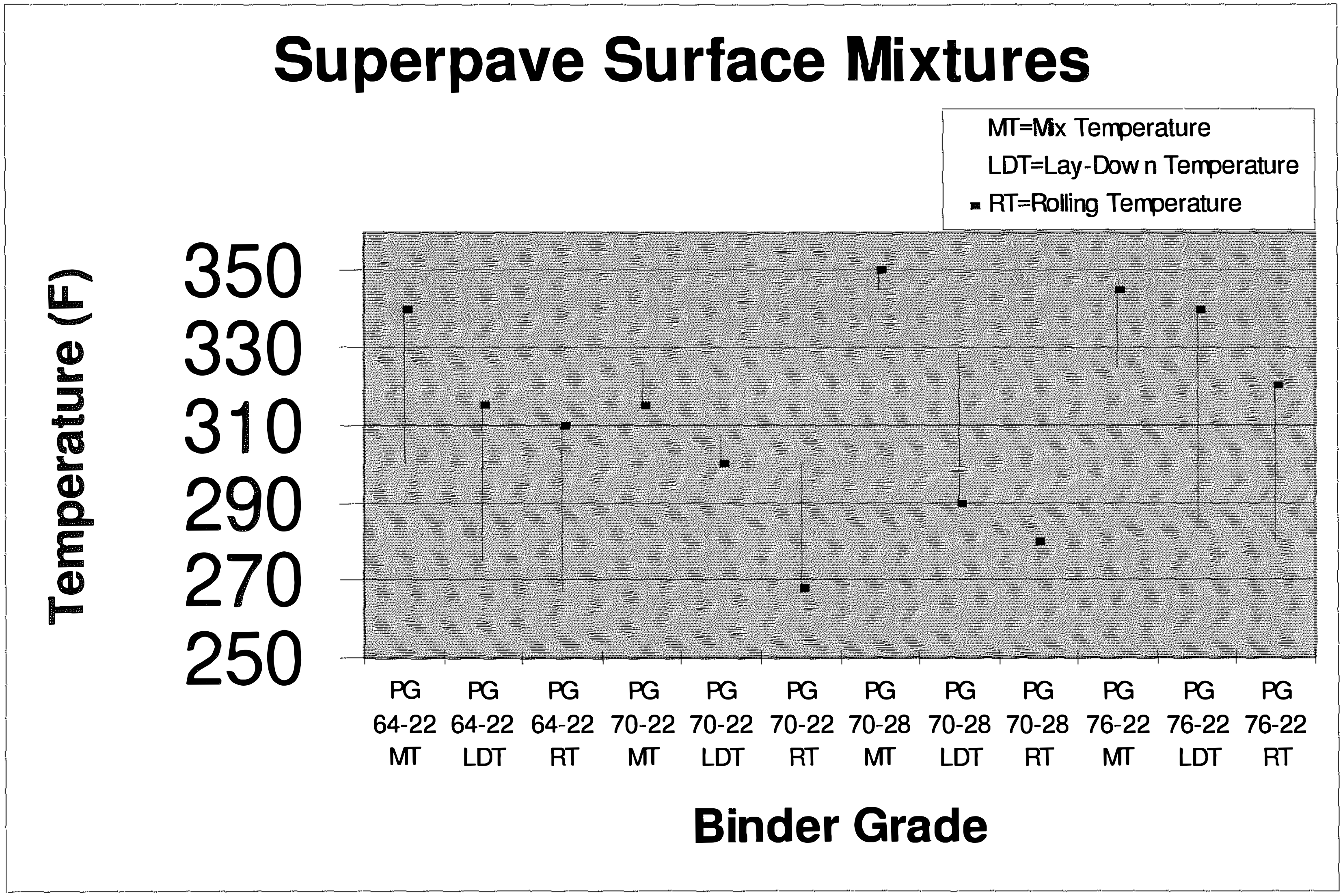

Figure 2. Mix, Lay-Down, and Rolling Temperatures for Superpave Surface Mixtures.

3.2 Haul Distance and Delay Times

3.2.1 Haul Distance

The average haul distance from the plant to the project sites was 10.5 miles. The maximum recorded distance was 25 miles (US 62, Carlisle County).

3.2.2 Delay Times

The average minimum delay time at all of the sites was approximately five minutes for each project. The average maximum delay time for each project was 13.5 minutes. The maximum delay time recorded was 60 minutes (KY 16, Kenton County).

3.3 Compaction

The level of compactive effort was evaluated for the different binders for both the base courses and the surface courses. The compactive effort required to achieve density was derived by multiplying the total number of passes by the weight of the roller in tons.

3.3.1 Base Course

The average compactive effort for the PG 64-22 base mixtures was approximately 109 ton-passes (results of four projects), 92 ton-passes for the PG 70-22 (result of one project), and 93 ton-passes for the PG 76-22 base mixtures (results of two projects) (Figure 3). The average compactive effort for all base mixtures was 98 ton-passes.

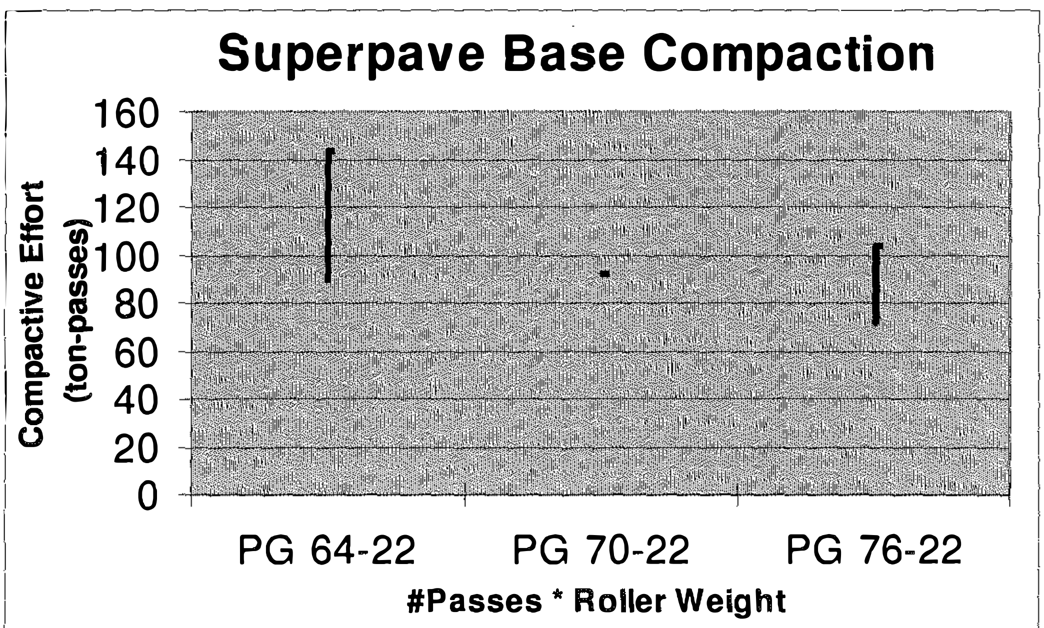

Figure 3. Compactive Effort Required for Superpave Base Mixtures.

3.3.2 Surface Course

The level of compactive effort for the surface mixtures was less than that required for the base mixtures. The average compactive effort for the surface mixtures was approximately 83 ton-passes (Figure 4). It appears there may not be any significant differences in compactive effort required for the different binder grades. Figure 4 contains nine projects constructed with a PG 64-22 binder, two with a PG 70-22 and a PG 70-28 binder, and five using a PG 76-22 binder.

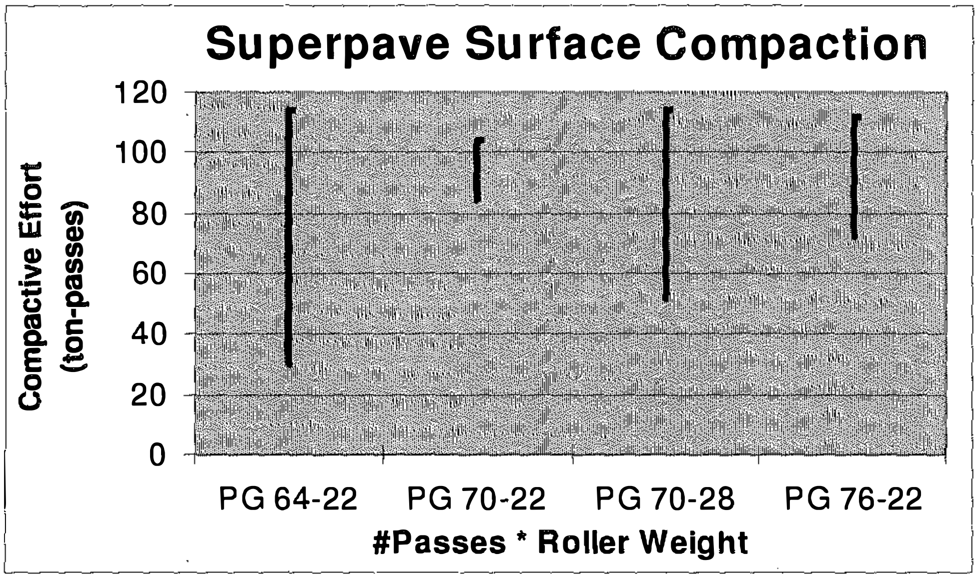

Figure 4. Compactive Effort Required for Superpave Surface Mixtures.

3.3.3 Comparison of Two Rollers Versus Three Rollers

A detailed analysis was conducted on the compactive effort of two rollers versus three rollers for both the base and surface mixtures.

3.3.3.1 Base Course

Figure 5 shows that greater compactive effort was provided by the first roller when compared to the second roller. Figure 6 shows that when three rollers are utilized, more compactive effort is provided by the third roller (the field data also indicated that half of the contractors used an additional third roller). It is likely that the mix has cooled, and more effort is needed to reach the target density. Figure 7 indicates that 22 percent less compactive effort was applied when using two rollers than when using three rollers.

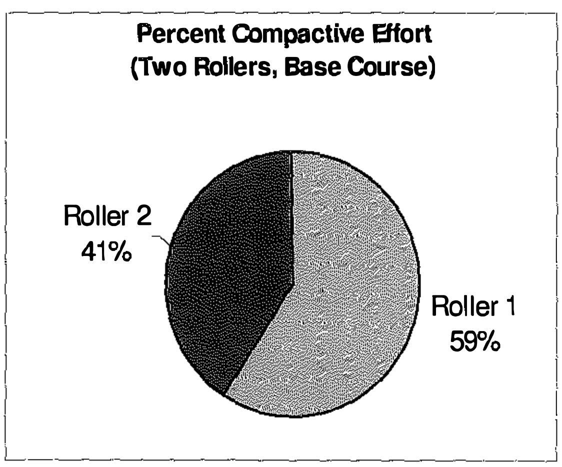

Figure 5. Percent Compactive Effort, Two Rollers, Base Course.

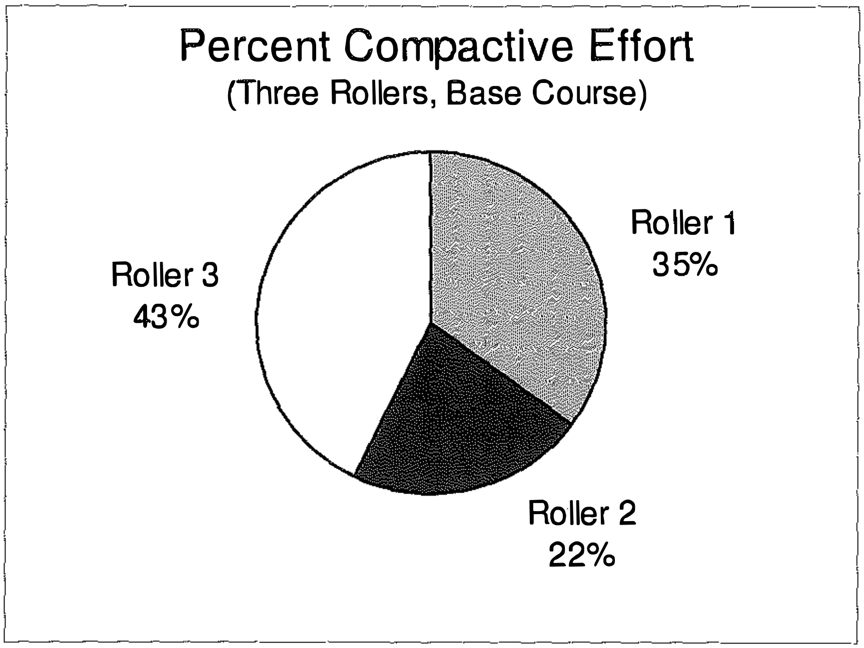

Figure 6. Percent Compactive Effort, Three Rollers, Base Course.

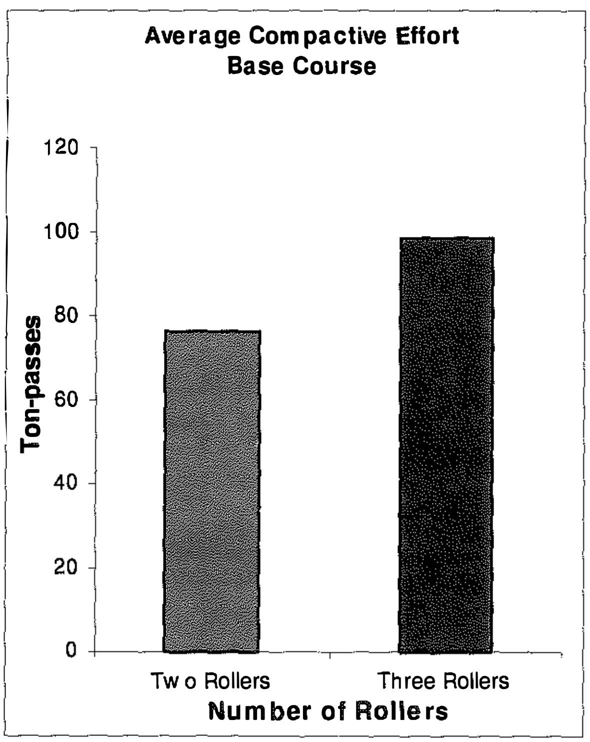

Figure 7. Compactive Effort, Two Rollers vs. Three Rollers.

3.3.3.2 Surface Course

Figure 8 shows that more compactive effort was provided by the second roller versus the first roller for surface mixtures. Figure 9 shows that when three rollers are used, more compactive effort is provided by the third roller than the second roller. Figure 10 indicates that 22 percent less compactive effort is provided by two rollers than when using three rollers.

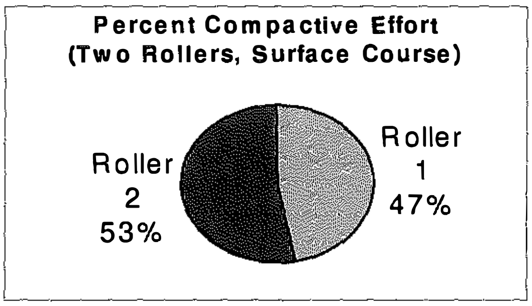

Figure 8. Percent Compactive Effort, Two Rollers, Surface Course.

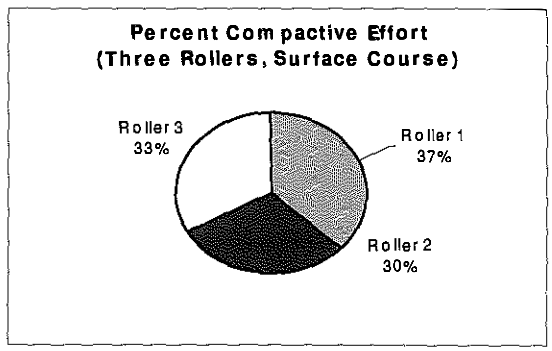

Figure 9. Percent Compactive Effort, Three Rollers, Surface Course.

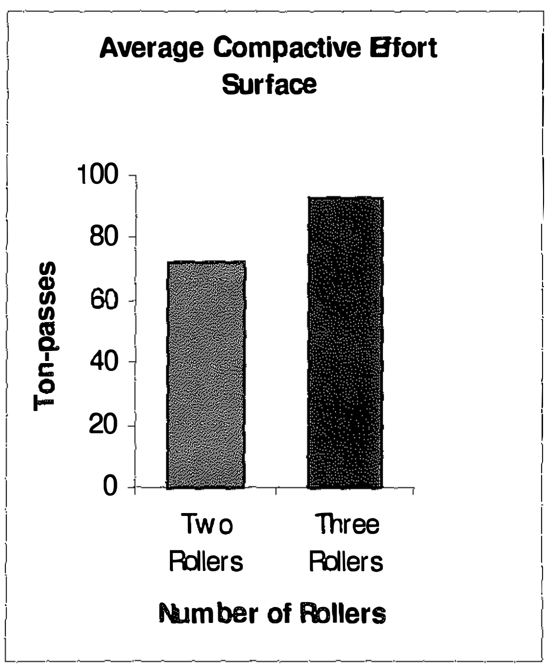

Figure 10. Compactive Effort, Two Rollers vs. Three Rollers.

3.4 Problems Observed During Construction

A total of 24 Superpave projects were observed by either KTC personnel, Department personnel, or both during construction. Problems documented on each of these projects are listed in Table 1 and summarized in Table 2. Projects constructed prior to the study and projects that were not documented are also listed. Summaries are also contained in Appendix B.

Table 1. Mix Design and Construction Problems Observed on Superpave Projects.

Route	County	Prior to Study=x Not visited=o	Low VMA	Low TSR	Low Density	Dips	Humps	Aggregate Segregation	Problems w/ Rolling Patterns	Tender Zone
US 641	Marshall-Calloway	X								
US 62	Marshall		X			X				
US 62	Carlisle				X					
US 68	Christian (MP 1-6)		X	X	X					
US68	Christian (MP 13-19)			X						
KY56	Union				X				X	
US 68BP	Logan		X							X
US 31E	Nelson					X	X		X	X
US421	Trimble				X				X	
KY 676	Franklin	X								
US 60	Jefferson	X								
I-64	Shelby-Franklin	X								
US 31W	Jefferson									
KY 16	Kenton		X							
US27	Campbell									
I-75	Boone	0								
US 127BP	Mercer	X								
I-64	Fayette						X			
KY 4	Fayette				X		X			
US 60	Woodford						X			
US27	Pulaski							X		
KY78	Lincoln		X							
US68	Mason	X								
KY 9	Mason								X	
KY 8	Lewis									X
US 23	Boyd									X
KY52	Estill		X							X
US25E	Knox								X	X
US 25E	Bell	0								
KY 550	Knott				X				X	
US 23	Pike							X		
US 23	Pike							X		

Table 2. Mix Design and Construction Problems								
Low VMA	Low TSR	Low Density	Dips	Humps	Aggregate Segregation	Thermal Segregation	Problems w/ Rolling Patterns	Tender Zone
26%	9%	26%	9%	17%	13%	Not evaluated on all projects	22%	22%

3.4.1 VMA and TSR

From the plant production or mix design side of Superpave construction, low VMA (voids-in-the mineral aggregate) and low TSR (tensile strength retained) were the most-reported problems. As shown in Table 2, 26 percent of the projects had low VMA and 9 percent had low TSR values.

3.4.2 Low Density, Tender Zones, and Rolling Patterns

From the lay-down or construction side of Superpave, compaction appeared to be the biggest problem. Low densities, tender zones, and problems establishing and controlling rolling patterns were reported on several of the projects. Compacting or achieving density was the most-reported problem from the Superpave projects. Twenty-six percent of the contractors reported having problems getting density. Trouble with tender zones and establishing rolling patterns were reported on 22 percent of the projects. Tender zones were recorded at temperatures between 170 and 280 °F. In most cases, the mixture was allowed to cool below the tender zone. Problems with establishing rolling patterns were likely due to changing air temperatures, changing lay-down temperatures, low roller weights, and working around tender zones. Several of the contractors indicated that the tender zone could be avoided by placing two heavy rollers right behind the paver and compacting the hot mixture quickly in order to achieve maximum density prior to the mat becoming tender.

3.4.3 Segregation

Segregation was noted on approximately 13 percent of the projects (Figures 11 and 12). This occurrence was reported on three of the projects. Segregation was observed at the ends of trucks and also at the centerline of the lane on some of the projects. In each case, a shuttle buggy or materials transfer vehicle (MTV) was not used. Contractors using MTV's indicated that it helped mitigate segregation problems. MTV's were used on 30 percent of the projects. Approximately 59 percent of the pavers were operated with the wings out. Ninety-six percent of the plants loaded the trucks with three drops. In one location on US 68/KY 80, the MTV caused rutting in the base course (Figures 13 and 14). From conversations with Cabinet personnel, it is believed that the subgrade in this area was weak.


Figure 11. Segregation Occurring on US 23, Pike County.


Figure 12. Segregation Occurring on US 23.

Figure 13. MTV Rutting Base Material.

Figure 14. Rutting Caused by MTV.

3.4.4 Transverse Humps

Transverse humps in the final lift were reported or observed on 17 percent of the projects. Humps had occurred on US 60 in Woodford County, KY 4 and I-64 in Fayette County, and US 31E in Nelson County during construction. On US 60, Department personnel indicated that the underlying geotextile material placed over the joints in the concrete pavement in 1982 may have been heated, which permitted the fabric to delaminate from the concrete. The binder in the mixture was changed from a PG 76-22 to a PG 64-22; lowering the mixing and compaction temperatures eliminated the humps.

Humps on KY 4 were not as pronounced, but appeared to be roller-related. It appears the breakdown roller was running up too close to the paver screed and then was backing off and working the mat. It is possible that the roller was creating a "bow wave" and that the wave was cooling while the remainder of the mat was being worked, thus leaving a small ridge. The humps were occurring approximately every 500 ft. Additionally, part of the problem may be related to thermal segregation. Since this project was paved at night, the chances of thermal segregation are higher.

The humps on I-64 occurred in the initial start-up in a wedge section (Figure 15). The humps decreased when the mat reached full thickness. It is unsure at this time what was producing the humps.

Humps on US 31E were observed on June 1, 1999, during a performance inspection.

Figure 15. Hump Occurring iu Mat on Interstate 64.

3.4.5 Thermal Segregation

Thermal segregation was observed during the placement of both base and surface courses on several Superpave projects. Temperature differentials of approximately 50 to 60 °F were observed. Thermal segregation appears to occur during transport and placement. The outer layer of the mixture in the trucks cools more rapidly, crusting over during transport. During the unloading process from the truck to the hopper, the cool outer layer (crust) appears to slide off the hotter mix and enters the hopper first when the bed of the truck is fully raised in one movement. This occurrence is shown in Figure 16 as the truck is dumping into the hopper on the MTV. Temperature differentials appear to be greater with increased coarseness of the mix.

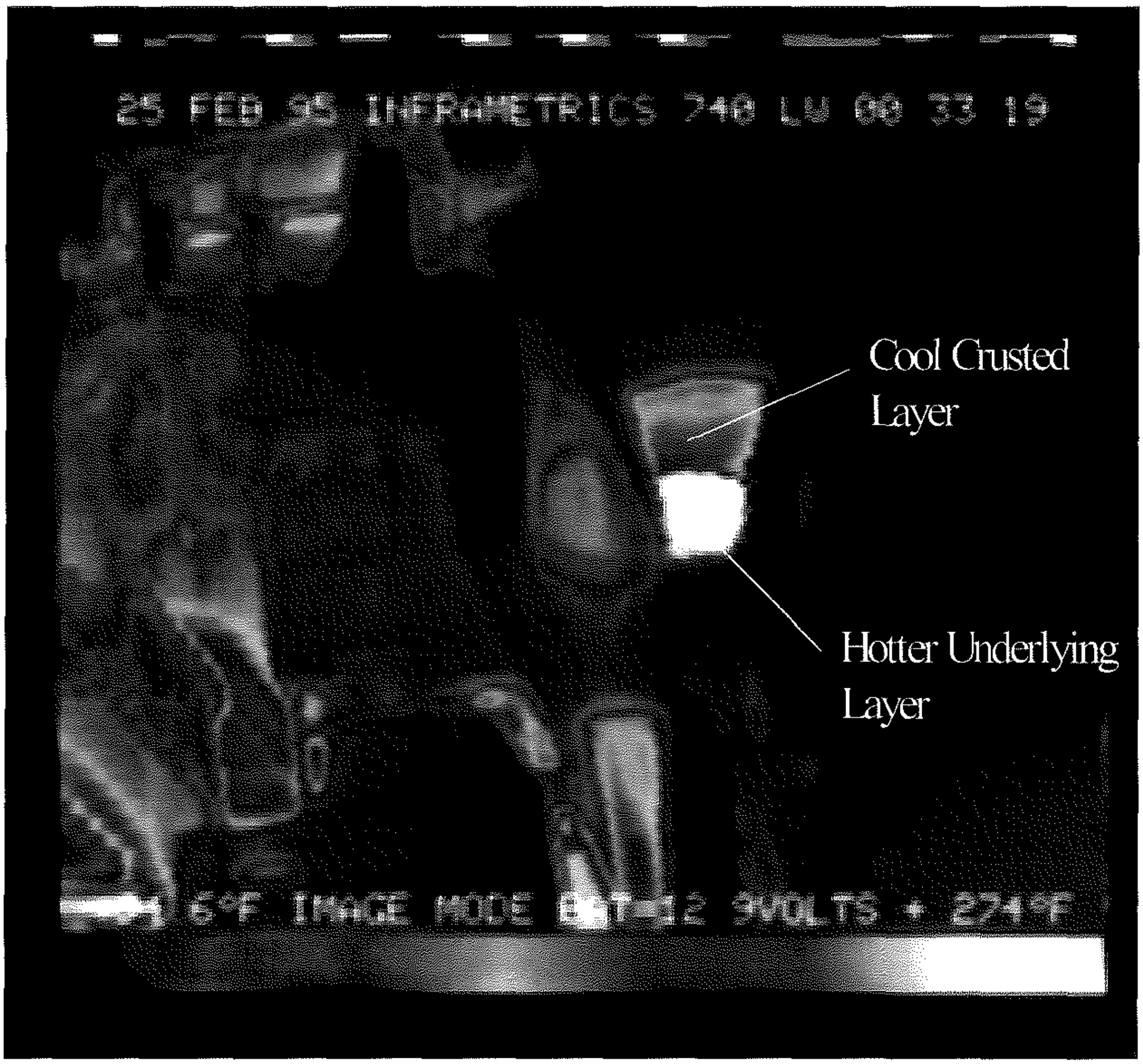

Figure 16. Truck Loading Into MTV.

Figure 17 is an infrared scan showing several hundred feet of pavement shortly after placement. The darker horizontal bands are thermal-segregated areas from each truck. The figure also indicates that the edges of the mat cool more rapidly.

Figure 18 shows a typical thermal scan when a break occurs in the paving train. The previously laid mixture has had time to cool, and the mixture in the hopper has retained a substantial amount of its initial heat. The cool, crusted layer for the new truck slides into the hopper first and is placed, and then the hotter center of the truck is placed.

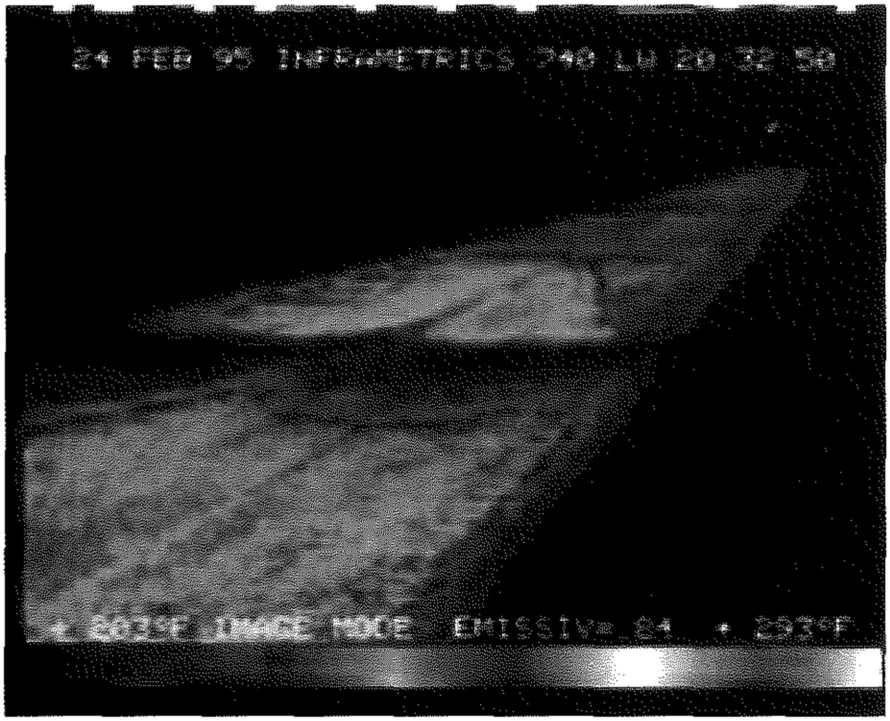

Figure 17. Thermal Segregation Observed in Base Being Placed on I-64.

The I-64 project was placed without the use of a MTV or any additional mixing prior to placement. The net result was that the beginning of each truckload could be precisely located by its thermal scan.

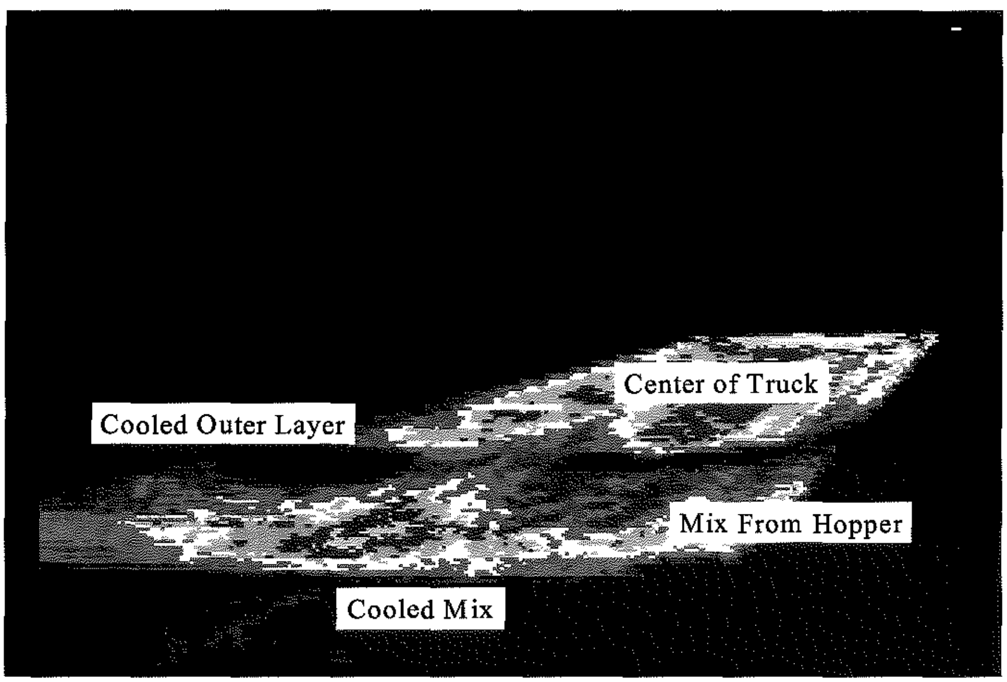

Figure 18. Thermal Segregated Areas in Newly Placed Mix.

Further testing was conducted on I-75 (Laurel County) where a MTV was being used to see if the additional mixing would help reduce the thermal segregation. In most cases, after passing through the MTV, the cooler, crusted layer from each truck was not visible during the thermal scan (Figure 19). Thermal segregation was observed in a few isolated areas in the pavement when a long break in the paving train had occurred (Figure 20). Also shown in Figure 20, the cool material had been partially mixed in with the warmer material and placed over a much wider area.

The effects of thermal segregation on the performance of the mix have not been fully evaluated. Nuclear density tests taken by the contractor on the I-64 project (Franklin County) showed, overall, approximately a four to five percent decrease in density in the thermally segregated areas.

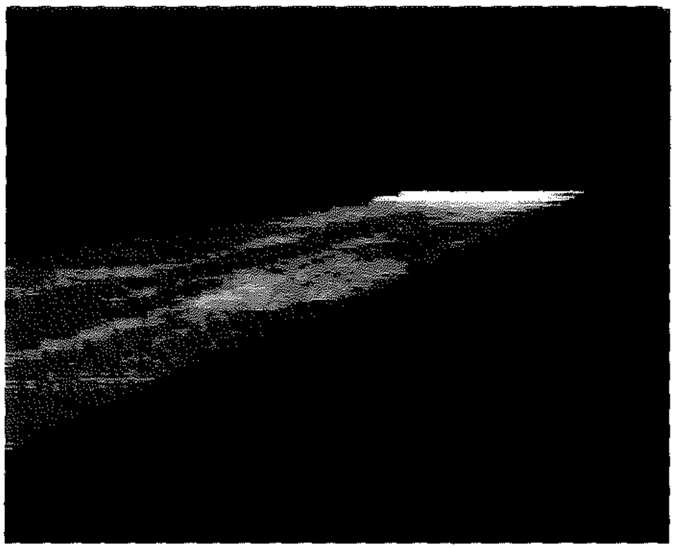

Figure 19. Thermal Signature of Pavement After Being Placed With the MTV.

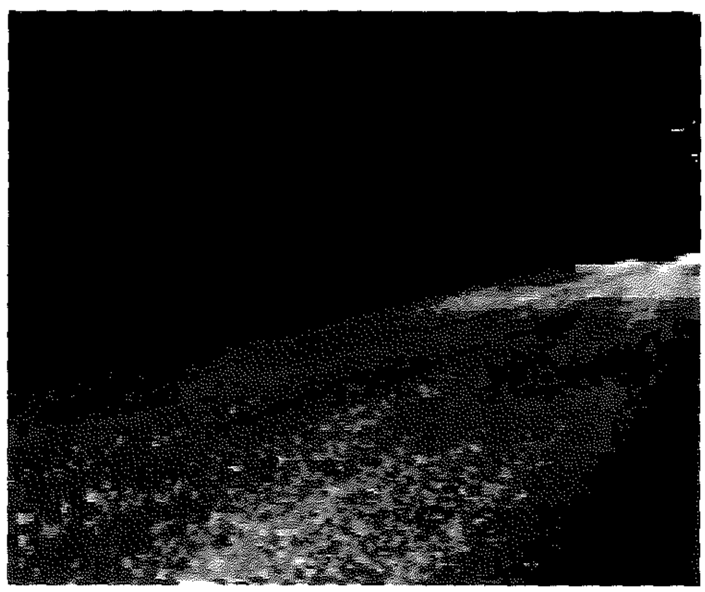

Figure 20. Thermal Segregation Observed on I-75 After a Long Break in the Paving Train.

3.5 Evaluation of Laboratory and Field Mixtures

A detailed analysis was conducted on the various properties of the Superpave mixtures from nine different Superpave projects. Initially, it was anticipated that data would be gathered from all of the Superpave projects constructed in 1998; unfortunately, the KTC was unable to obtain all the information. Properties evaluated included asphalt binder content (AC), VMA, and both laboratory and field density. This information is contained in Appendix C.

3.5.1 Percent VMA Versus Laboratory Mixture Density

Figure 21 illustrates the ranges of laboratory densities and percent VMA from the 27 Superpave projects that were evaluated. The VMA for the base mixtures ranged from as high as 14.2 percent to as low as 11.0 percent. Surface mixtures ranged from approximately 17.5 to 13.0 percent. As would be expected, the VMA decreased with increased density of the mixture. Laboratory densities for base mixtures ranged from 149.5 to 154.5 lb./cu. ft. (pcf) and surface mixtures ranged from approximately 145.0 to 153 pcf.

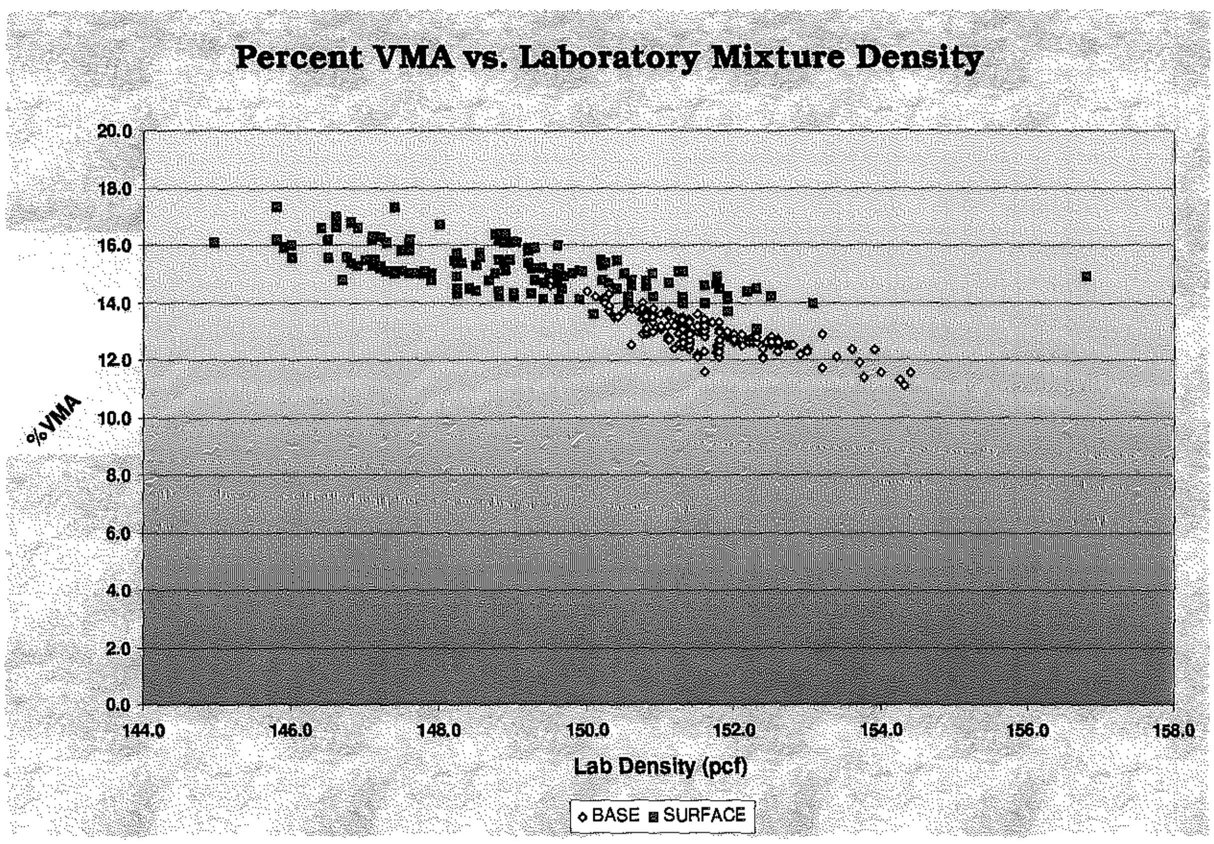

Figure 21. VMA vs. Laboratory Mixture Density.

3.5.2 VMA Versus Field Core Density

Figure 22 illustrates the range of field core densities and VMA from the Superpave projects. The actual core densities for the base mixtures ranged from 143.5 to 153.0 pcf, and the surface mixtures ranged from 138.5 to approximately 149.0 pcf. The laboratory densities showed a greater dependence on VMA than did the field cores.

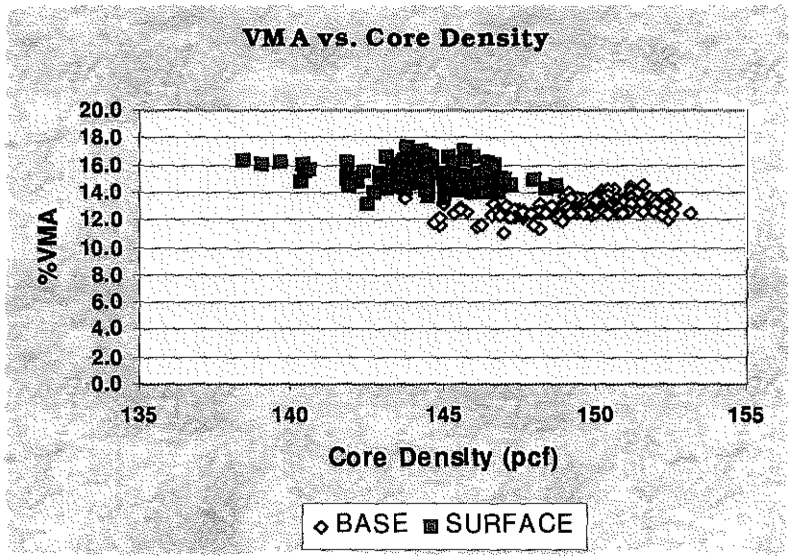

Figure 22. VMA Versus Core Density.

3.5.3 Field Density Relative to Laboratory Design Density

Figure 23 shows the distributions of the ratios of the core densities to the laboratory densities for surfaces and bases. There was a greater spread in the surface distributions, where as the base distribution is more tightly clustered.

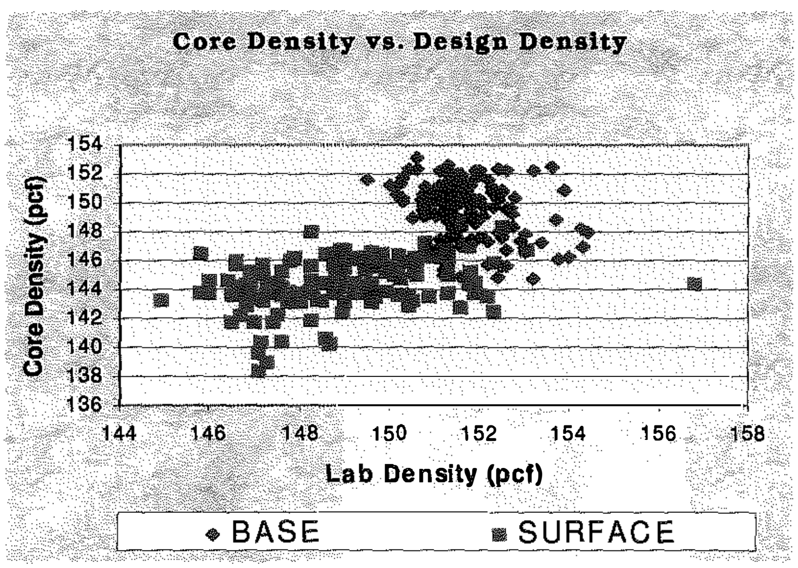

Figure 23. Core Density Versus Lab Density.

3.5.4 AC versus Core Density

The AC versus core density was evaluated for the various projects (Figure 24). Figure 24 shows that the AC of the surface mixtures averaged about 5.5 percent and about 4.0 percent for the base mixtures. The AC in the mixture, in the range used in this study, is not a significant factor in core densities.

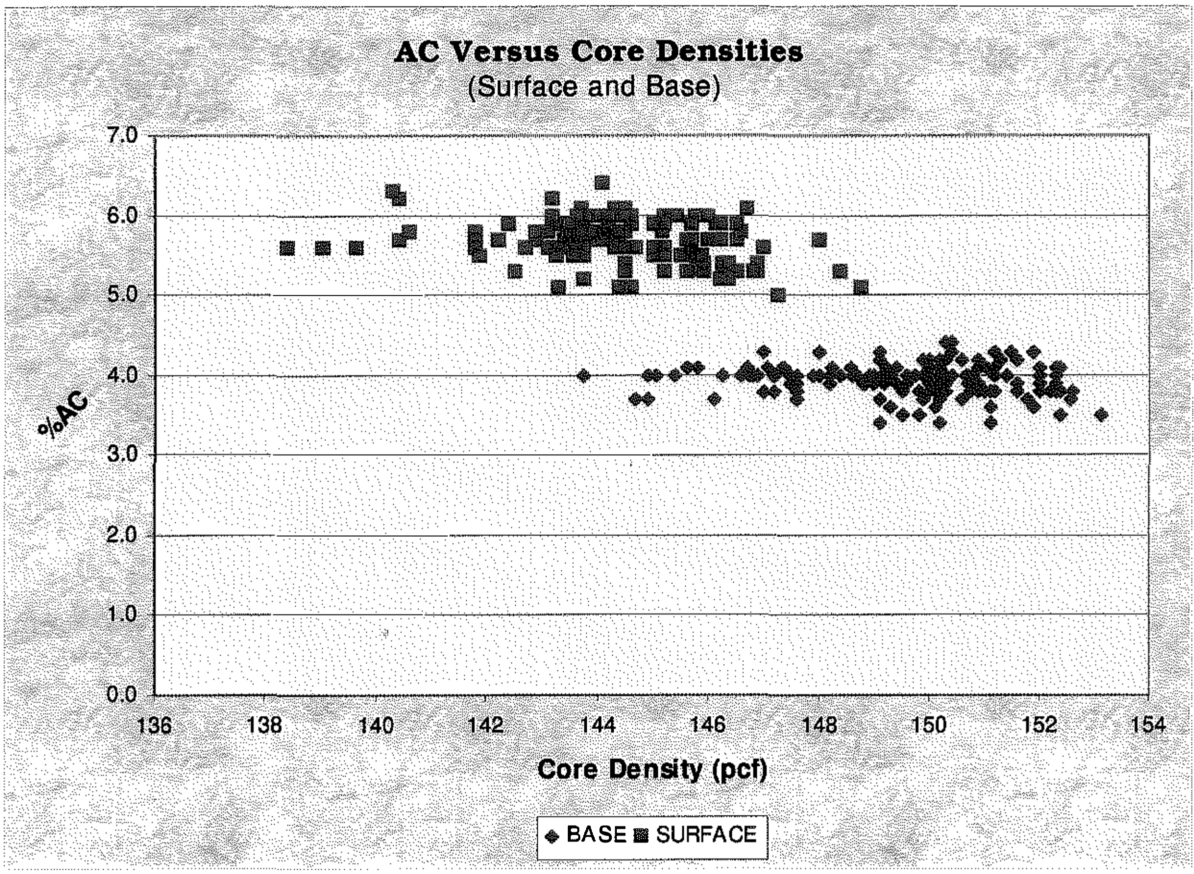

Figure 24. AC vs. Core Density.

4.0 SUPERPAVE PERFORMANCE

Performance and distress information was collected on all the Superpave projects between August, 19 98 and June, 1999. This information is included in Tables 3 and 4. Slight to significant distress (rutting, bleeding, transverse cracking, spalling, and/or moisture problems) was observed on approximately 60 percent of the projects. A significant portion (37 percent) of this distress was transverse cracking. Approximately 33 percent of the Superpave projects were overlaying old asphalt pavements over older concrete pavements. These projects included:

US 641, Marshall-Calloway Co.
US 62, Marshall Co.
US 31E, Nelson Co.
US 60, Jefferson Co.
US 31W, Jefferson Co.
KY 16, Kenton Co.
US 60, Woodford Co.
US 23, Pike Co.
KY 676, Franklin Co.
I-64, Shelby-Franklin Co.
KY 550, Knott Co.

4.1 US 641, Marshall-Calloway County

The resurfacing of US 641 was completed in August, 1997. Bleeding was observed throughout the project (Figure 25). Bleeding was more pronounced near the intersection of KY 121 and KY 80. At these locations, the bleeding was concentrated in the wheelpaths of the outside lanes (Figures 26 and 27). Approximately 3/8 of an inch of rutting was also measured in these locations. The remainder of the project had very little rutting. Most sites had 1/16 of an inch or less.

Figure 25. Bleeding Observed on US 641.

Figure 26. Bleeding on US 641 Near the Intersection of KY 121.

Figure 27. Bleeding on US 641 Near the Intersection of KY 80.

4.2 US 62, Marshall County

The Marshall County project was completed in July, 1998. The site was originally inspected for performance in August, 1998. Rut measurements taken in August indicated that approximately 75 percent of the project had rutted approximately 1/8 of an inch. Transverse ridges were also observed in several areas (Figures 28 and 29). The site was revisited on April 8, 1999. The areas of rutting had increased, but the maximum depth of rutting had not changed. The transverse humps or ridges had started to crack (Figure 30).

Figure 28. Transverse Ridge in Pavement on US 62.

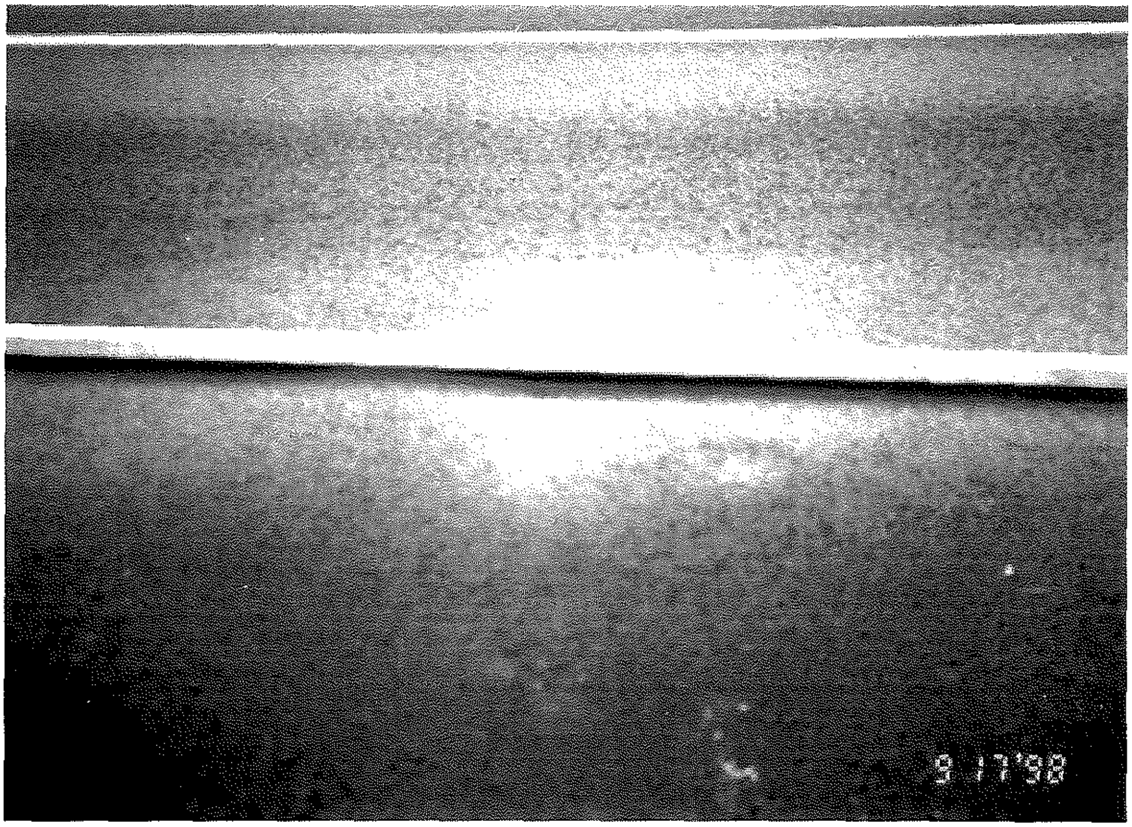

Figure 29. View of Transverse Ridge on US 62.

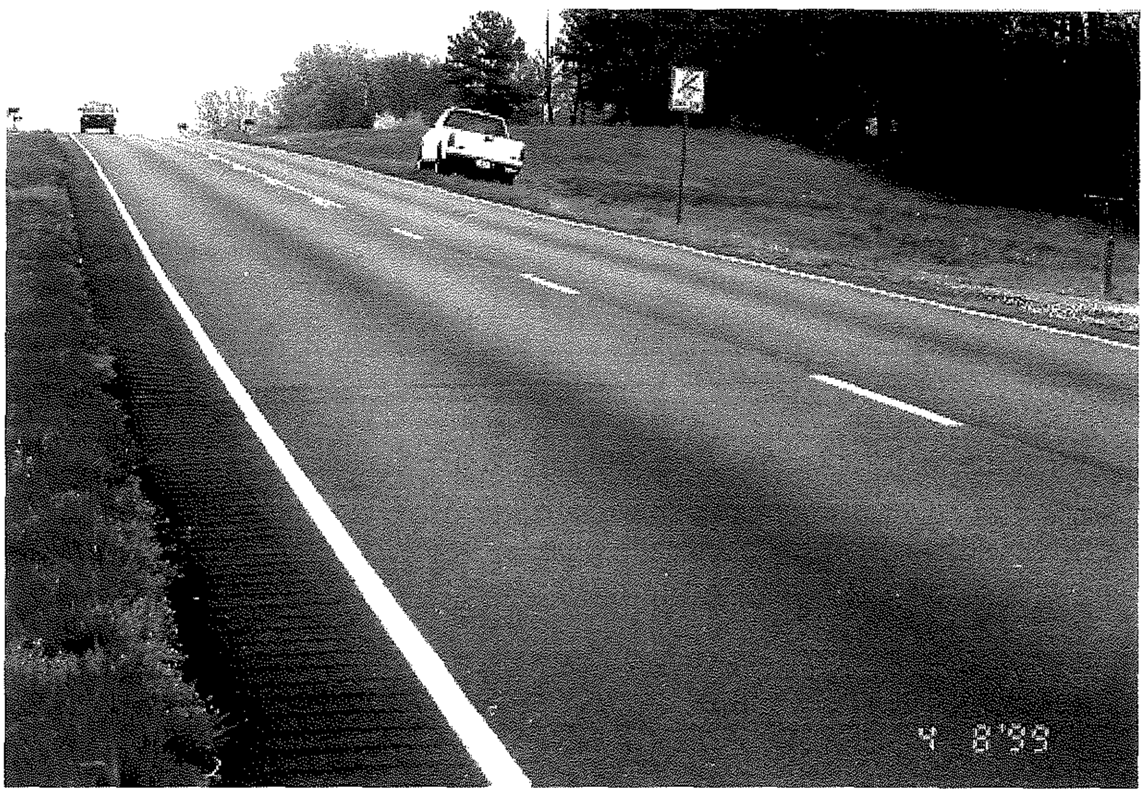

Figure 30. Cracking Occurring in Transverse Ridges on US 62.

4.3 US 31E, Nelson County

The Nelson County project was completed in November, 1998. The project was visually inspected in November, 1998. At that time, the pavement had rutted approximately 1/16 to 1/8 of an inch. Transverse ridges were also visible in several areas throughout the project. It is unsure if the ridges were caused by the underlying concrete pavement.

4.4 US 60, Jefferson County

The project was completed in August, 1997. Due to traffic in this area, it has been difficult to completely evaluate the performance of this project. Transverse cracking has occurred throughout the project. It appears that the joints of the old concrete pavement are reflecting back through the asphalt pavement.

Figure 31. Transverse Cracking on US 31W in Jefferson Co.

4.5 US 31W, Jefferson County

The Jefferson County project was completed in November, 1998. The site was inspected on January 13, 1999. Numerous transverse cracks were observed throughout the project (Figures 31 and 32). It appeared that the transverse cracking was reflective cracking from the old concrete pavement. Rutting was observed in 21 of the 28 locations that were inspected.

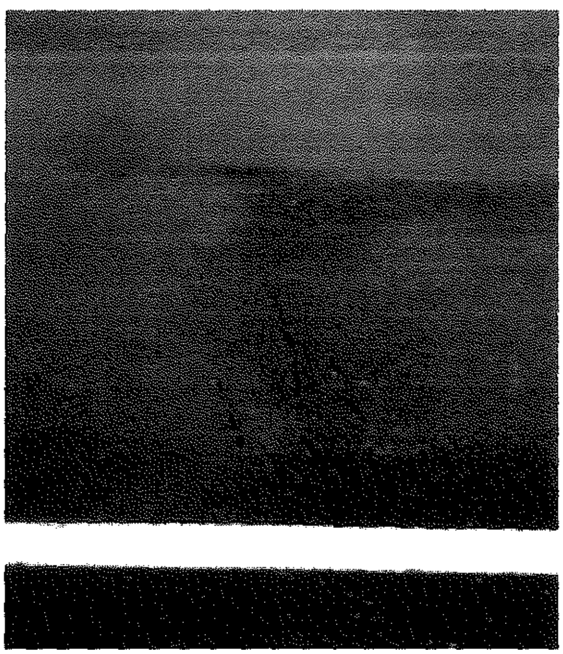

Figure 32. Transverse Cracking on US 31W in Jefferson Co.

4.6 KY 16, Kenton County

The project was completed in November, 1998. The site was inspected on January 11, 1999. Rutting had occurred in 14 of the 16 locations that were measured. The rutting ranged from 1/16 to 1/8 of an inch. Transverse cracking had occurred throughout the project (Figures 33 and 34). It appears that the transverse cracking is reflective cracking from the old concrete pavement. In several locations, the pavement had risen around the cracking (Figure 35).

Figure 33. Transverse Crack in New Overlay on KY 16.

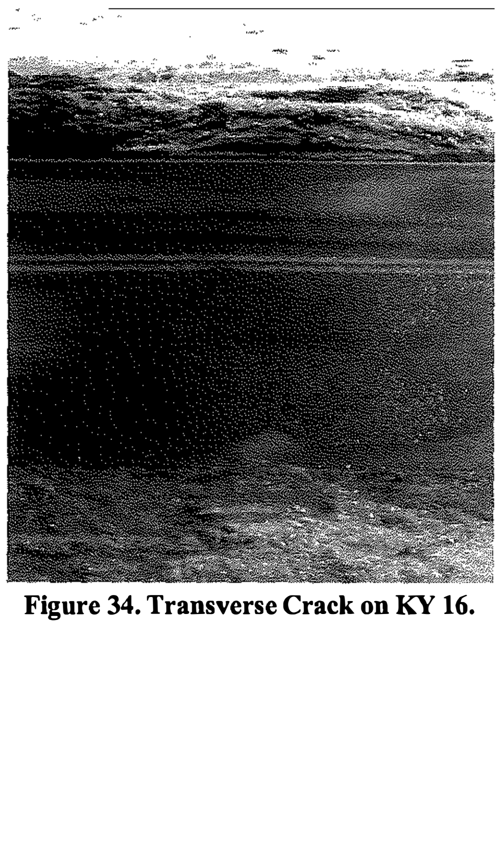

Figure 34. Transverse Crack on KY 16.

Figure 35. Pavement Raised Around Crack on KY 16.

4.7 US 60, Woodford County

The project was completed in June, 1998. The project was inspected on January 19, 1999. The pavement had rutted 1/16 to 1/8 of an inch in 70 percent of the areas tested. The maximum recorded rut depth was 3/16 of an inch. This measurement was recorded near the start of the project. Transverse cracking had occurred throughout the project (Figures 36 and 37). Approximately 240 transverse cracks were noted. It appears that most of the transverse cracking was reflective cracking from the old concrete pavement.

Figure 36. Transverse Cracking, US 60.

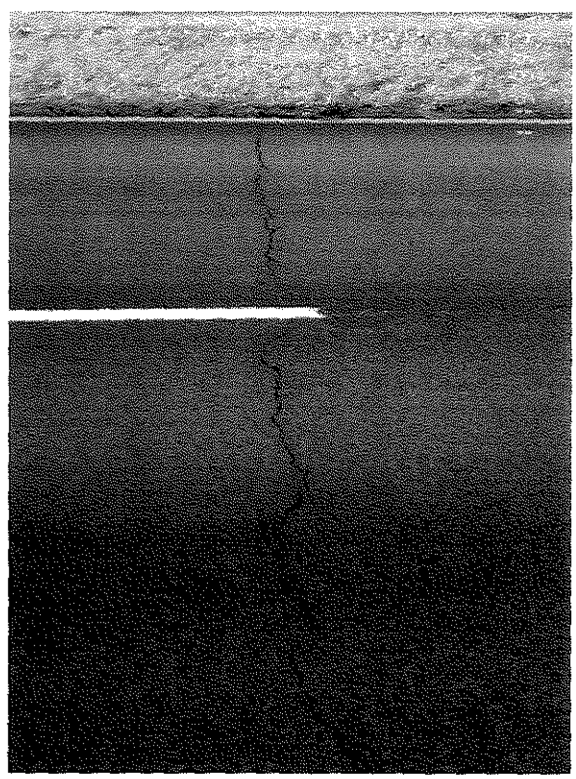

Figure 37. Transverse Cracking, US 60.

4.8 KY 676, Franklin County

This project was completed in November, 1995. The project was last inspected on April 20, 1999. The pavement had many longitudinal cracks in the wheelpath and very little transverse cracking (Figures 38 and 39). The maximum rut depth observed was 3/16 of an inch. The average rut depth was between 1/16 and 1/8 of an inch.

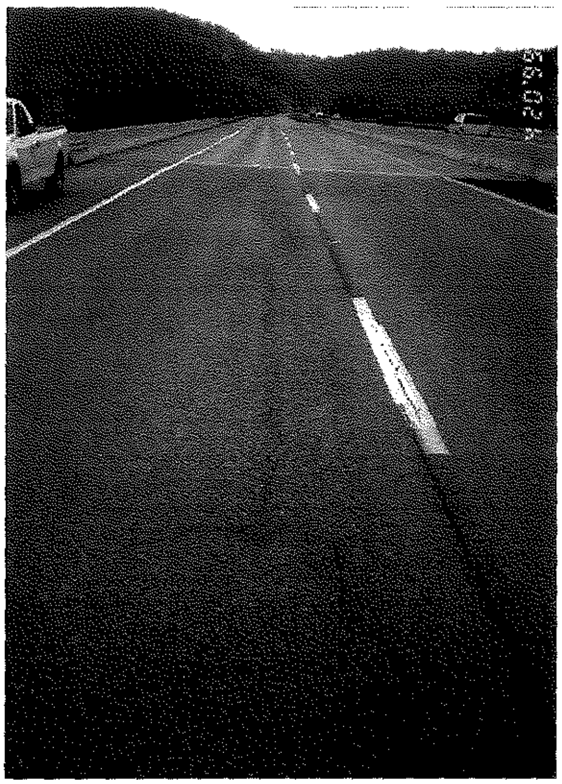

Figure 38. KY 676, Franklin Co.

Figure 39. KY 676, Franklin Co.

4.9 I-64, Shelby-Franklin County

This project was completed in July, 1997. The project was last inspected on April 20, 1999. The pavement showed numerous transverse cracks (Figure 40). Rut depths were not obtained at this site.

4.10 US 23, Pike County

This project was completed in November, 1998. The project was last inspected on May 13, 1999. Approximately 1/16 of an inch of rutting had occurred throughout the project. An isolated base failure was observed which was affecting the overlying pavement structure (Figure 41). Water was observed coming up through the pavement between Milepoints 12.7 to 14.0 (Figures 42 and 43).

Figure 40. I-64, Shelby-Franklin Co.

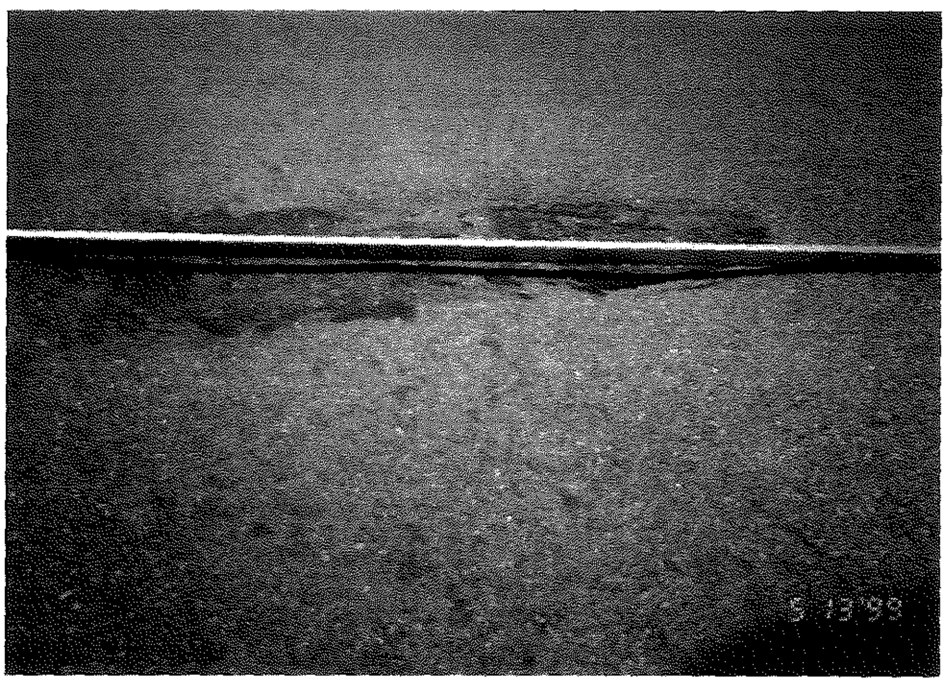

Figure 41. US 23, Pike Co.

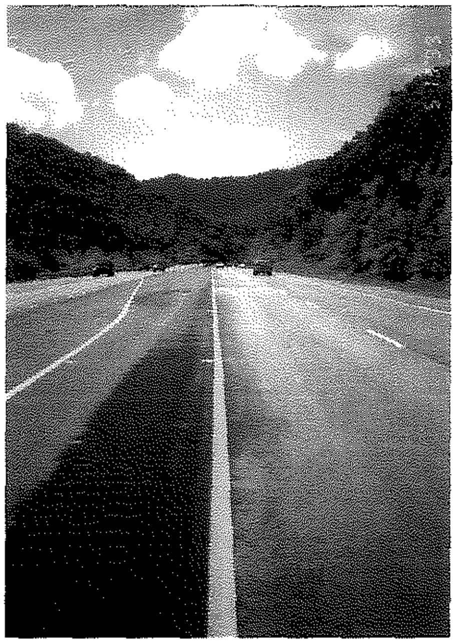

Figure 42. US 23, Pike Co.

Figure 43. US 23, Pike Co.

4.11 KY 550, Knott County

This project was completed in September, 1998. The project was last inspected on May 21, 1999. Longitudinal cracking was observed at the edge of the pavement in three locations (Figure 44). It appears that some of the longitudinal cracking may be due to a possible failure in the subgrade. Rutting ranged from 1/16 to 1/8 of an inch.

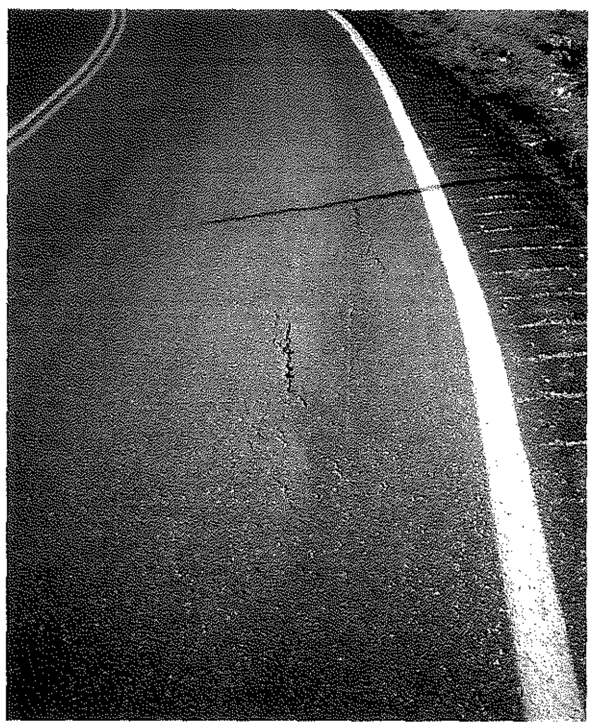

Figure 44. Longitudinal Cracking, Possible Base Failure (KY 550).

Table 3. Surface Distress Comparison of Superpave Projects.

Project	Route	County	Design Methodology	Old Pavement	Bleeding	Transverse Ridges	Transverse Cracking	Longitudinal Cracking	Surface Repairs	Max. Rutting (in.)
1	US 641	Marshall-Calloway	Superpave	AC	X					3/8
2	US62	Marshall	Superpave	AC		X				1/8
3	US62	Carlisle	Superpave	AC			X			1/4
4	KY 56	Union	Superpave	AC			X			1/16
5	US 68BP	Logan	Superpave	AC			X			1/16
6	US31E	Nelson	Superpave	AC/PCC		X				1/8
7	US421	Trimble	Superpave	AC/PCC						1/16
8	KY 676	Franklin	Superpave	AC			X	X		3/16
9	US60	Jefferson	Superpave	AC/PCC			X			---
10	I-64	Shelby-Franklin	Superpave	AC/PCC			X			—
11	US31W	Jefferson	Superpave	AC/PCC			X			1/8
12	KY 16	Kenton	Superpave	AC/PCC			X			5/16
13	US27	Campbell	Superpave	AC/PCC						1/16
14	US 127BP	Mercer	Superpave	AC						1/4
15	I-64	Fayette	Superpave	AC/PCC	X	X	X			1/8
16	KY 4	Fayette	Superpave	AC	X					—
17	US60	Woodford	Superpave	AC/PCC			X			3/16
18	KY 78	Lincoln	Superpave	AC						1/8
19	US68	Mason	Superpave	AC						3/16
20	KY 9	Mason	Superpave	AC						1/16
21	KY 8	Lewis	Superpave	AC						1/8
22	US23	Boyd	Superpave	AC						1/8
23	KY 52	Estill	Superpave	AC						1/16
24	US25E	Knox	Superpave	AC	X					1/16
25	US25E	Bell	Superpave	AC	X					1/8
26	KY 550	Knott	Superpave	AC				X		1/8
27	US23	Pike	Superpave	AC					X	1/16

(AC = asphaltic concrete, PCC = Portland Cement Concrete, AC/PCC = PCC overlaid with AC)

Table No. 4. Performance and Distress Information of Completed Superpave Projects in Kentucky.

District	Route	County	Date Completed	Date Inspected	Max. Rutting (in.)	Accumulated ESAL'S	Pavement Type	COMMENTS
1	US 641	Marshall-Calloway	9-97	4-8-99	3/8	426,488	AC	Bleeding in numerous spots throughout the project. Most spots are one foot in diameter or less. Bleeding more severe at intersection of KY 80 and KY 121. Maximum of rutting was also measured in bleeding areas near the intersections. Very little rutting on most of the project. Most sites had 1/16 of an inch.
1	US 62	Marshall	8-98	1) 9-17-98 2) 4-8-99	1/8	43,439	AC	1) More rutting than on most jobs. Rutting at about 3/4 of the sites measured. Also, marks on the road that look like they were made by roller pushing. 2) Rutting has increased throughout; maximum rutting still 1/8 of an inch. Roller marks have cracked or are starting to crack.
1	US 62	Carlisle	8-98	1) 9-17-98 2) 5-11-99	3/8 1/4	17,355	AC	1) Very little rutting; most sites had 0 to 1/16 of an inch. 2) More rutting and many transverse cracks.
2	KY 56	Union	8-98	1) 9-17-98 2) 5-12-99	1/16	12,557	AC	1) Almost no rutting, only two sites had any rutting. 2) Very little rutting and some transverse cracks.
3	US 68BP	Logan	9-98	1) 1-11-99 2) 5-27-99	1/16	61,956	AC	1) Little rutting, 36 out of 73 sites. 2) Little to no change in rutting.
4	US 31E	Nelson	10-98	1) 11-17-98 2) 6-1-99	1/8	53,354	AC/PCC	More rutting than on most jobs; most sites had 1/16 to 1/8 of an inch of rutting. Also, ridges from rollers observed.
5	US421	Trimble	9-98	1) 1-20-99 2) 5-20-99	1/16	13,573	AC/PCC	Almost no rutting, only 8 sites out of 30 sites.
5	KY 676	Franklin	11-95	4-20-99	3/16	206,108	AC	Many longitudinal cracks in wheelpath; very few transverse cracks; most rutting 1/16 to 1/8 of an inch.

5	US 60	Jefferson	9-97	Spring 98	-----	33,729	AC/PCC	Numerous transverse cracks throughout the project. Appears to be caused by old concrete.
5	1-64	Shelby-Franklin	7-97	4-20-99	----	2,119,337	AC/PCC	180 transverse cracks.
5	US 31W	Jefferson	11-98	1) 1-13-99 2) 6-1-99	1/8	68,214	AC/PCC	More rutting than most sites: rutting at 21 out of 28 sites. Many transverse cracks.
6	KY 16	Kenton	11-98	1) 1-11-99 2) 5-28-99	1/8 5/16	22,458E E=Estimated	AC/PCC	More rutting than most sites, rutting at 14 out of 16 sites. Many transverse cracks.
6	US 27	Campbell	Not Finished	1-10-99	1/16	N/A	AC/PCC	Almost no rutting; only three out of 23 sites had any rutting
7	US 127BP	Mercer	6-97	1) 8-26-98 2) 6-2-99	1/8 1/4	N/A	AC	1) Almost no rutting; only 7 out of 34 sites had any rutting. 2) Little rutting.
7	I-64	Fayette	7-98	2-3-99	1/8	468,937	AC/PCC	Very little rutting; about 50 percent of the sites had rutting.
7	KY 4	Fayette	7-98	2-3-99	-----	150,283	AC	Appears to be performing acceptably; no visible cracking.
7	US 60	Woodford	6-98	1) 1-19-99 2) 6-2-99	3/16	161,559	AC\PCC	More rutting than on most jobs, rutting at 25 out of 35 sites. Many transverse cracks (240 cracks counted). Significant rutting at the start of the project. Most rutting was 1/16 of an inch.
8	KY 78	Lincoln	9-98	1) 11-18-98 2) 5-19-99	1/8	6,667E	AC	Very little rutting; about half the sites have rutting, mostly 1/16 of an inch.
9	US 68	Mason	9-97	1) 10-29-98 2) 6-3-99	1/8 3/16	43,957	AC	1) Very little rutting; about 50 percent of the sites have rutting. 2) Rutting at most sites, mostly 1/16 of an inch.
9	KY 9	Mason	10-98	1) 10-29-98 2) 6-3-99	1/16	185,502	AC	1) Almost no rutting, only two sites had 1/16 inch ruts. 2) Most sites had 1/16 of an inch rutting.
9	KY 8	Lewis	7-98	1) 9-10-98 2) 6-3-99	1/8	641,666E	AC	1) Almost no rutting; only two sites out of 28 had any signs of rutting. 2) Most sites had 1/16-in. ruts.

9	US 23	Boyd	10-98	1) 2-9-99 2) 5-14-99	1/8	200,999	AC	1) Very little rutting; only 19 out of 64 sites have rutting. Spalling was observed in a few areas of the surface. The surface appeared to be very open. 2) Most sites had 1/16-in. ruts.
10	KY 52	Estill	9-98	1) 2-22-99 2) 6-4-99	1/16	80,000E	AC	Almost no rutting; only five out of 22 sites had rutted.
11	US 25E	Knox	8-98	1)2-99 2) 5-24-99	1/16	387,401	AC	1) Almost no rutting; only 11 sites out of 64 had rutted. 2) Slight increase in rutting; Bleeding observed in isolated areas.
11	US 25E	Bell	8-98	1) 8-24-98 2) 5-24-99	1/8	130,151-769,291	AC	1) Almost no rutting; only three sites out of 12 had rutted. 2) Slightly more rutting. Bleeding observed in a couple of areas.
12	KY 550	Knott	9-98	1) 1-27-99 2) 5-21-99	1/8	9,000E	AC	1) Almost no rutting; only nine out of 24 sites had rutted. Longitudinal cracks were observed at the edge of the road in three locations. 2) Most sites had rutted 1/16 of an inch.
12	US 23	Pike	11-98	1) 1-29-99 2) 5-13-99	1/16	275,000E at site 700,000 two miles north	AC	1) Almost no rutting; only twp sites out of 64 had rutted. Moisture was observed on the pavement in several locations. 2) 1/16 of an inch of rutting at most sites; moisture coming through the pavement at Milepoints 12.7 to 14.0. Isolated base failure also observed.

5.0 MARSHALL PERFORMANCE

Several Marshall design projects were selected to compare field performance between the Superpave design method and that of the Marshall method. The Marshall projects selected were of similar age and near in location to Superpave projects. Sixteen Marshall projects were selected for comparison. Performance surveys on the selected Marshall projects were performed in May and June of 1999. This information is contained in Appendix B and in Table 5 and Table 6. Over 90 percent of the Marshall projects had slight to moderate distress (bleeding, transverse cracking, longitudinal cracking, and surface patching). Listed and shown below are approximately a quarter ofthe projects inspected. These projects illustrate the typical distresses that were observed on the majority of the Marshall projects.

5.1 KY 15, Perry County

The project was completed in 1997 and last inspected on May 5, 1999. Approximately 1/16 to 1/8 of an inch rutting had occurred throughout the project. Longitudinal and transverse cracking was observed in numerous areas throughout the project. Longitudinal cracking is shown in Figure 45.

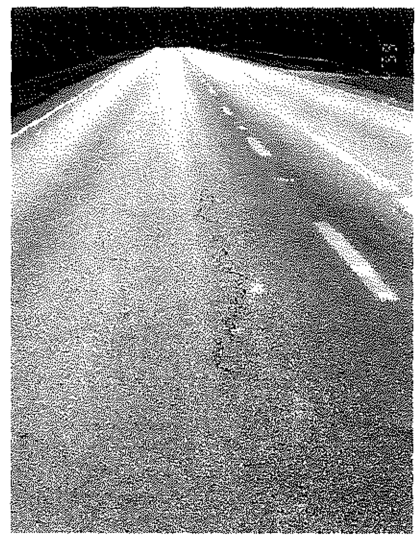

Figure 45. KY 15, Perry County.

5.2 I-75, Whitley-Laurel County

The project was completed in 1997 and was last inspected on May 5, 1999. Bleeding was observed in the southbound lane in many areas (Figure 46). Rut measurements were not obtained due to traffic.

Figure 46. I-75, Laurel County.

5.3 US 119, Pike County

The project was completed in June, 1998. It was last inspected on May 13, 1999. The project had more than average rutting. The average rut depth ranged from 1/8 to 3/16 of an inch. Several small spots of bleeding and longitudinal cracks were observed. Longitudinal cracks were observed along the pavement edge (Figures 47 and 48).

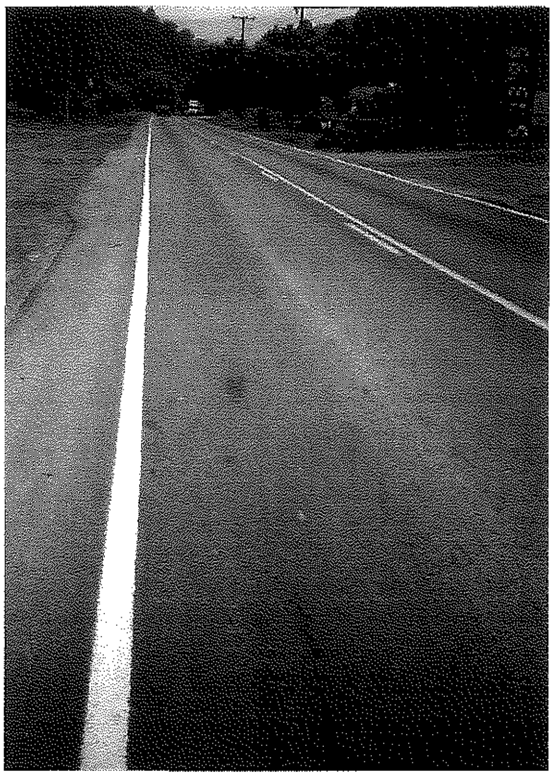

Figure 47. US 119, Pike Co.

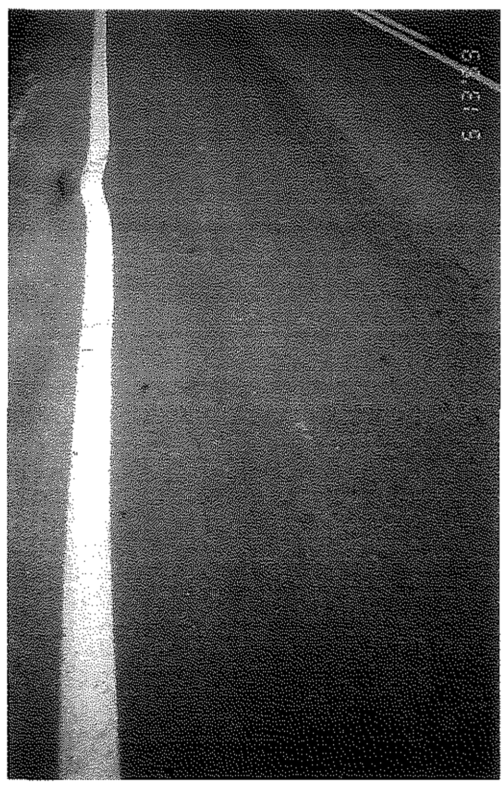

Figure 48. US 119, Pike Co.

5.4 US 641N, Marshall County

US 641N was completed in 1997 and inspected on May 11, 1999. Several different types of distresses were observed throughout the project. Distresses included transverse cracking, longitudinal cracking, bleeding, and potholes (Figures 49-52).

Figure 49. US 641N, Marshall Co.

Figure 50. US 641N, Marshall Co.

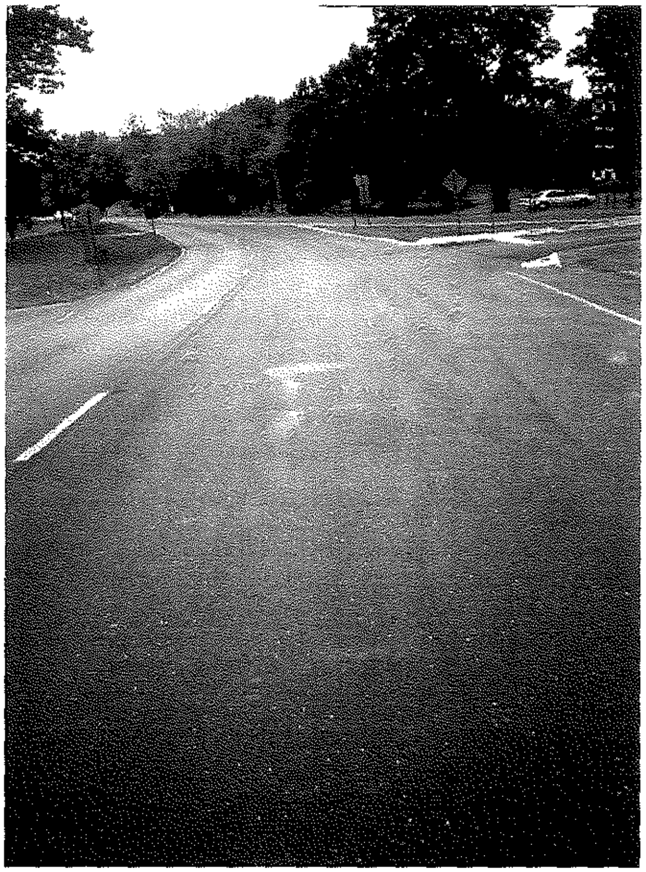

Figure 51. US 641N, Marshall Co.

Figure 52. US 641N, Marshall Co.

Table 5. Surface Distress Comparison of Marshall Projects.

Project	Route	County	Design Methodology	Old Pavement	Bleeding	Transverse Cracking	Longitudinal Cracking	Surface Repairs	Maximum Rutting (in.)
28	US 641N	Marshall	Marshall	AC	X	X		X	1/4
29	US 641S	Marshall	Marshall	AC					1/16
30	US45	McCracken	Marshall	AC		X			5/16
31	US60	Daviess	Marshall	AC/PCC	X				3/16
32	US60	Union	Marshall	AC/PCC	X	X			1/4
33	WKP	Muhlenberg	Marshall	AC\PCC	X				1/4
34	WKP	Grayson	Marshall	AC/PCC	X				1/16
35	KY 4	Fayette	Marshall	AC	X			X	1/8
36	I-64	Fayette	Marshall	AC/PCC	X				---
37	KY 15	Perry	Marshall	AC		X	X	X	3/16
38	I-75	Whitley-Laurel	Marshall	AC/PCC	X		X		---
39	US 119	Pike	Marshall	AC	X		X		5/16
40	US23	Pike	Marshall	AC	X	X			1/16
41	US23	Lawrence	Marshall	AC	X				1/16

(AC/PCC = Asphalt over concrete)

Table 6. Performance and Distress Information of Select Marshall Projects in Kentucky.

District	Route	County	Date Completed	Date Inspected	Maximum Rutting (in.)	Accumulated ESAL'S	Pavement Type	Comments
1	US 641N	Marshall	11-97	5-11-99	1/4	76,298	AC	Bleeding in several areas throughout the project. Significant amount of transverse cracking. Isolated area where several potholes had been patched. The pavement had rutted in most areas 1/16 of an inch. At Milepoint 7.75, 1/4 in. ruts were measured.
1	US 641S	Marshall	11-98	5-11-99	1/16	25,433	AC	Rutting was minimal, with maximum being 1/16 of an inch.
1	US45	McCracken	9-98	5-11-99	5/16	270,201	AC?	More than average rutting. Rutting was 1/8 to 3/16 of an inch and higher. Maximum rut depth of 5/16 of an inch had occurred at Milepoints 8.75 and 8.9. Many transverse cracks.
2	US 60	Daviess	1997	5-12-99	3/16	1,275,277	AC/PCC	Average rutting of approximately 1/16 of an inch. Maximum 3/16 in. rut occurred at the start of the project. Small spots of bleeding observed in several areas.
2	US 60	Union	1997	5-12-99	1/4	136,787	AC/PCC	More than average rutting. Average rut depth of 1/8 to 3/16 of an inch. Maximum rut of 1/4 of an inch measured in several areas. Transverse cracking had occurred approximately every 25 to 50 ft., with some as little as 10 ft. apart. A few isolated spots of bleeding were also observed.
2	WKP	Muhlen.	1998	5-7-99	1/4	302,281	AC/PCC	Minimal rutting. Few small areas of bleeding. One was 18 to 24 in. across, everything else was considerably smaller.
4	WKP	Grayson	11-98	5-3-99	1/16	76,337	AC/PCC	Little to no rutting. Isolated bleeding past the construction joint. Surface appeared to be very tight/closed in areas. From a distance, areas looked wet but were not.

7	KY 4	Fayette	9-97	6-3-99	1/8	533,752	AC	Minimal rutting of 1/16 of an inch throughout. Maximum of 1/8 of an inch measured in a few areas. A couple of areas of bleeding and a pothole that had been patched were observed. In a couple of areas, the pavement was breaking up and potholes were starting to form.
7	I-64	Fayette	2-97	5-6-99	1/8	1,808,757	AC/PCC	Several small spots of bleeding throughout the project. Water observed at the centerline.
10	KY 15	Perry	1997	5-5-99	3/16	532,973E-2,248,148	AC	Rutting of 1/16 to 1/8 of an inch on the average. Maximmn rut depth of 3/16 of an inch was measured at one location. Many longitudinal cracks in the wheelpaths and transverse cracks. Pavement had been patched towards the end of the project in the northbound lane.
11	I-75	Whitley-Laurel	1997	5-5-99	------	2,700,231	AC/PCC	Rut measurements were not taken due to traffic. In the southbound lane, many areas of bleeding in wheelpaths. Most areas were several feet long, and the pavement appeared to be sunken. On the northbound side, there were several small areas of bleeding.
12	US 119 EB	Pike	6-98	5-13-99	5/16	417,857	AC	More than average rutting. Average rut depth of approximately 1/8 to 3/16 of an inch, 1/4 and 5/16 in. ruts measured in several areas. Several small spots of bleeding and several longitudinal cracks along the edge of the pavement.
12	US 23	Pike	7-98	5-13-99	1/16	1,173,340	AC	Minimal rutting. A few small isolated spots of bleeding and one transverse crack.
12	US 23	Lawrence	1998	5-14-99	1/16	6,241,864	AC	Minimal rutting. A few small isolated spots of bleeding.

6.0 PERFORMANCE COMPARISON FOR SUPERPAVE VERSUS MARSHALL

6.1 Visual Field Performance

Distress information from both the Superpave and the Marshall projects has been summarized and is contained in Table 7. As shown in Table 7, significantly more bleeding has occurred on the Marshall projects. These projects also contained more longitudinal cracking and surface patching.

Table 7. Surface Distress Comparison of Superpave Versus Marshall Mixtures.

Project	Route	County	Design	Old Pavement	Bleeding	Transverse Ridges	Transverse Cracking	Longitudinal Cracking	Surface Patching	Maximum Rutting (in.)
1	US 641	Marshall-Calloway	Superpave	AC	X					3/8
2	US 62	Marshall	Superpave	AC		X				1/8
3	US 62	Carlisle	Superpave	AC			X			1/4
4	KY 56	Union	Superpave	AC			X			1/16
5	US 68BP	Logan	Superpave	AC			X			1/16
6	US 31E	Nelson	Superpave	AC/PCC		X				1/8
7	US 421	Trimble	Superpave	AC/PCC						1/16
8	KY 676	Franklin	Superpave	AC			X	X		3/16
9	US 60	Jefferson	Superpave	AC/PCC			X			---
10	I-64	Shelby-Franklin	Superpave	AC/PCC			X			---
11	US 31W	Jefferson	Superpave	AC/PCC			X			1/8
12	KY 16	Kenton	Superpave	AC/PCC			X			5/16
13	US 27	Campbell	Superpave	AC/PCC						1/16
14	US 127BP	Mercer	Superpave	AC						1/4
15	I-64	Fayette	Superpave	AC/PCC	X	X	X			1/8
16	KY 4	Fayette	Superpave	AC	X					---
17	US 60	Woodford	Superpave	AC/PCC			X			3/16
18	KY 78	Lincoln	Superpave	AC						1/8
19	US 68	Mason	Superpave	AC						3/16
20	KY 9	Mason	Superpave	AC						1/16
21	KY 8	Lewis	Superpave	AC						1/8
22	US 23	Boyd	Superpave	AC						1/8
23	KY 52	Estill	Superpave	AC						1/16
24	US 25E	Knox	Superpave	AC	X					1/16
25	US 25E	Bell	Superpave	AC	X					1/8
26	KY 550	Knott	Superpave	AC				X		1/8
27	US 23	Pike	Superpave	AC					X	1/16
28	US 641N	Marshall	Marshall	AC	X		X		X	1/4
29	US 641S	Marshall	Marshall	AC						1/16
30	US 45	McCracken	Marshall	AC			X			5/16
31	US 60	Daviess	Marshall	AC/PCC	X					3/16
32	US 60	Union	Marshall	AC/PCC	X		X			1/4
33	WKP	Muhlenberg	Marshall	AC\PCC	X					1/4
34	WKP	Grayson	Marshall	AC/PCC	X					1/16
35	KY 4	Fayette	Marshall	AC	X				X	1/8
36	I-64	Fayette	Marshall	AC/PCC	X					1/8
37	KY 15	Perry	Marshall	AC			X	X	X	3/16
38	I-75	Whitley-Laurel	Marshall	AC/PCC	X			X		---
39	US 119	Pike	Marshall	AC	X			X		5/16
40	US 23	Pike	Marshall	AC	X		X			1/16
41	US 23	Lawrence	Marshall	AC	X					1/16

6.2 Rutting

The average rut depth for each Superpave and Marshall project is shown in Figure 53. Figure 54 shows the same information as a function of accumulated equivalent, single-axle loads (ESAL's). To date, there appears to be very little or no correlation between ESALs and rutting. The average rut depth for the Superpave projects was 0.069 and 0.098 in. for the Marshall projects. This information indicates that 30 percent less rutting has occurred on the Superpave projects.

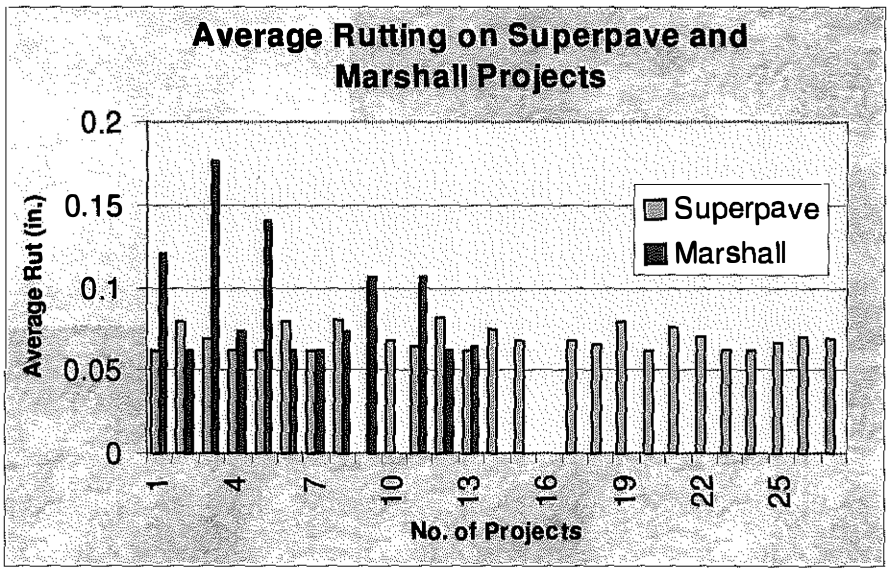

Figure 53. Average Rut Depth for Superpave and Marshall Mixes.

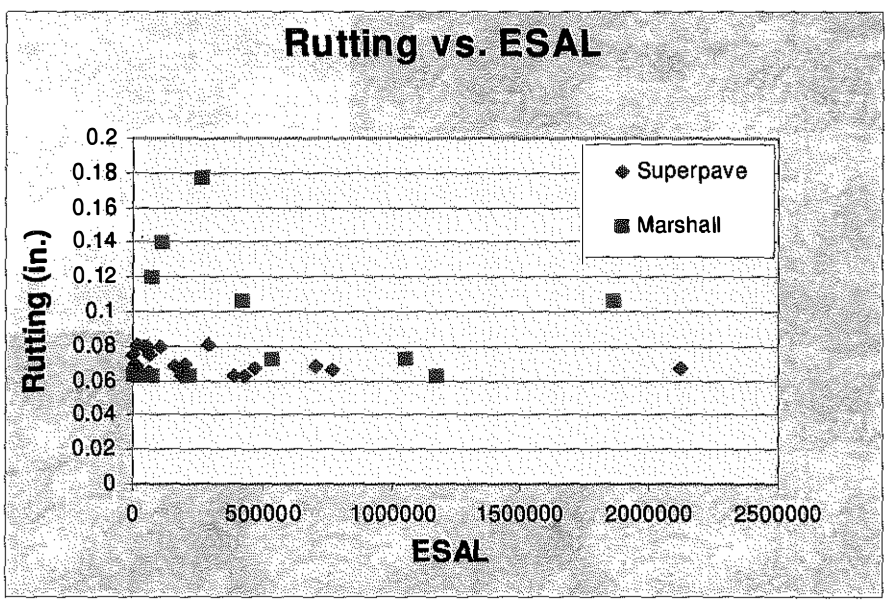

Figure 54. Rutting vs. ESAL.

6.3 Ride Index for Superpave and Marshall Mixtures

An attempt was made to obtain initial Ride Index (R.I.) data from each of the Superpave and Marshall projects. Initial R.I. data were only obtained on approximately half of the projects. Figure 55 shows the initial R.I. data that were obtained. The data indicate that the initial R.I. value for both the Superpave mixtures and the Marshall mixtures is approximately the same. The average R.I. for the Marshall projects is slightly higher. This phenomenon is likely due to the higher number of Interstate and Parkway projects, which would tend to raise the average R.I.

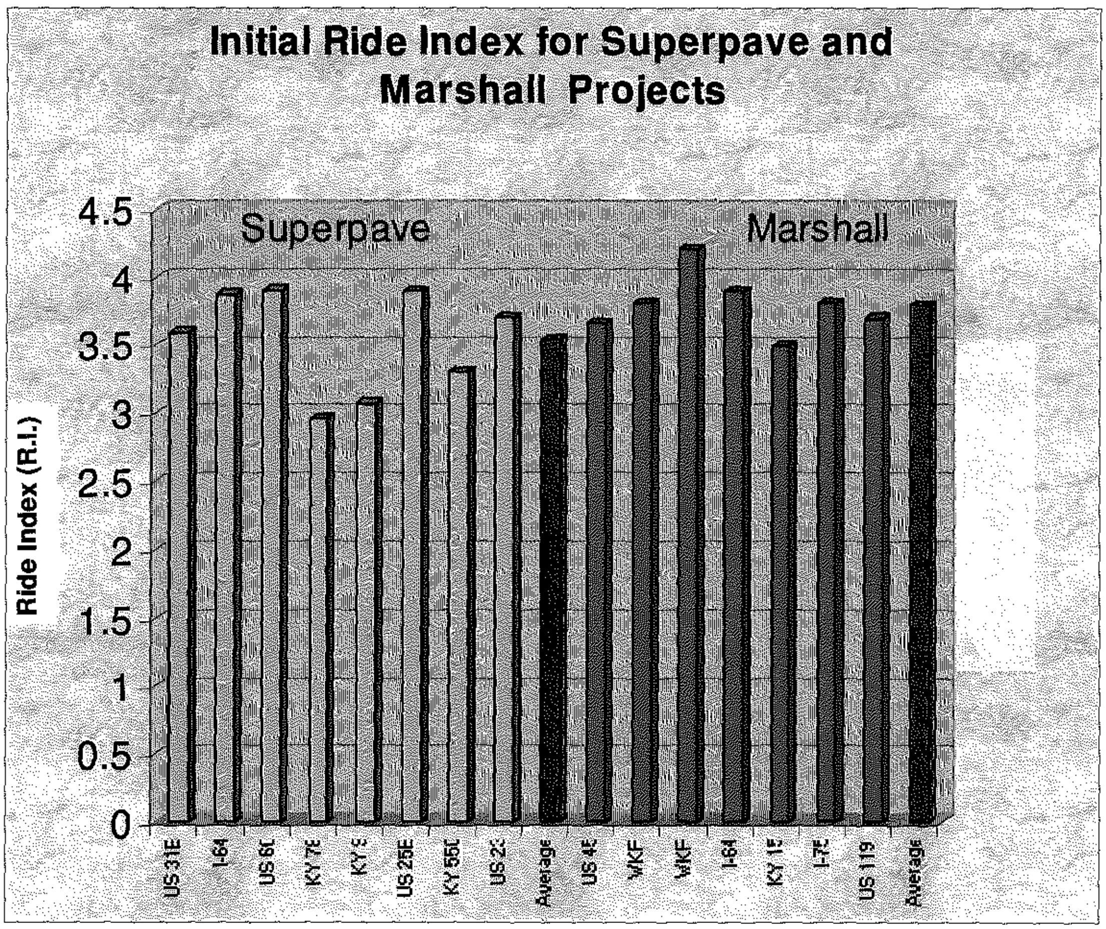

Figure 55. Initial Ride Index for Superpave and Marshall Projects.

7.0 COST DATA

The average unit price for Superpave versus Marshall mixtures was compared for both surface and base mixtures. The low and high end of the unit bid prices for Marshall mixtures were used for comparison. These are shown by the red upper boundary line and the lower blue boundary line. As shown in Figure 56, the average unit bid price for Superpave surface mixes between 1998 and 1999 fall within the high and low boundaries of the Marshall surface mixtures. This also holds true for the base mixtures as shown in Figure 57.

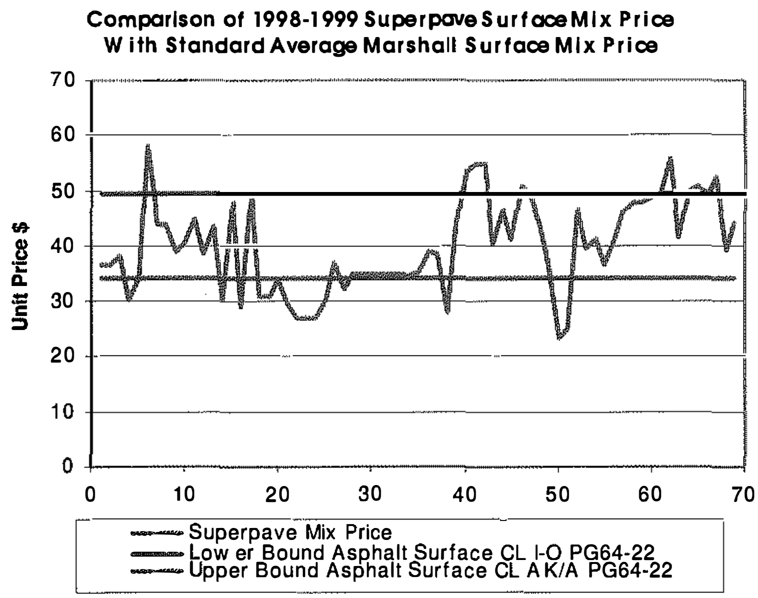

Figure 56. Comparison of Superpave Surface Prices to Marshall Surface Prices.

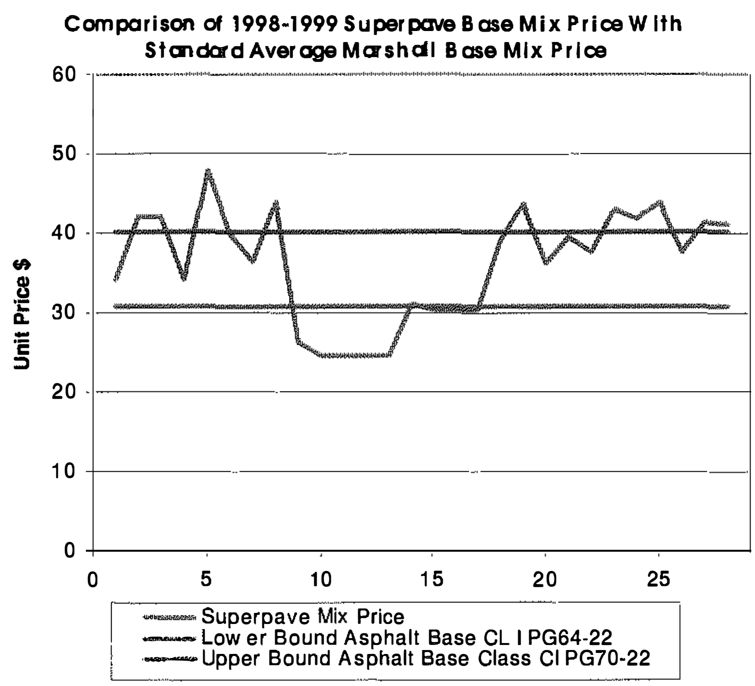

Figure 57. Comparison of Superpave Base Prices to Marshall Base Prices.

Figure 58 shows the average unit bid prices for Superpave mixtures with various binder grades. The prices range from approximately 32 to $45 per ton. Figure 58 also indicates that the higher-grade binders are more expensive.

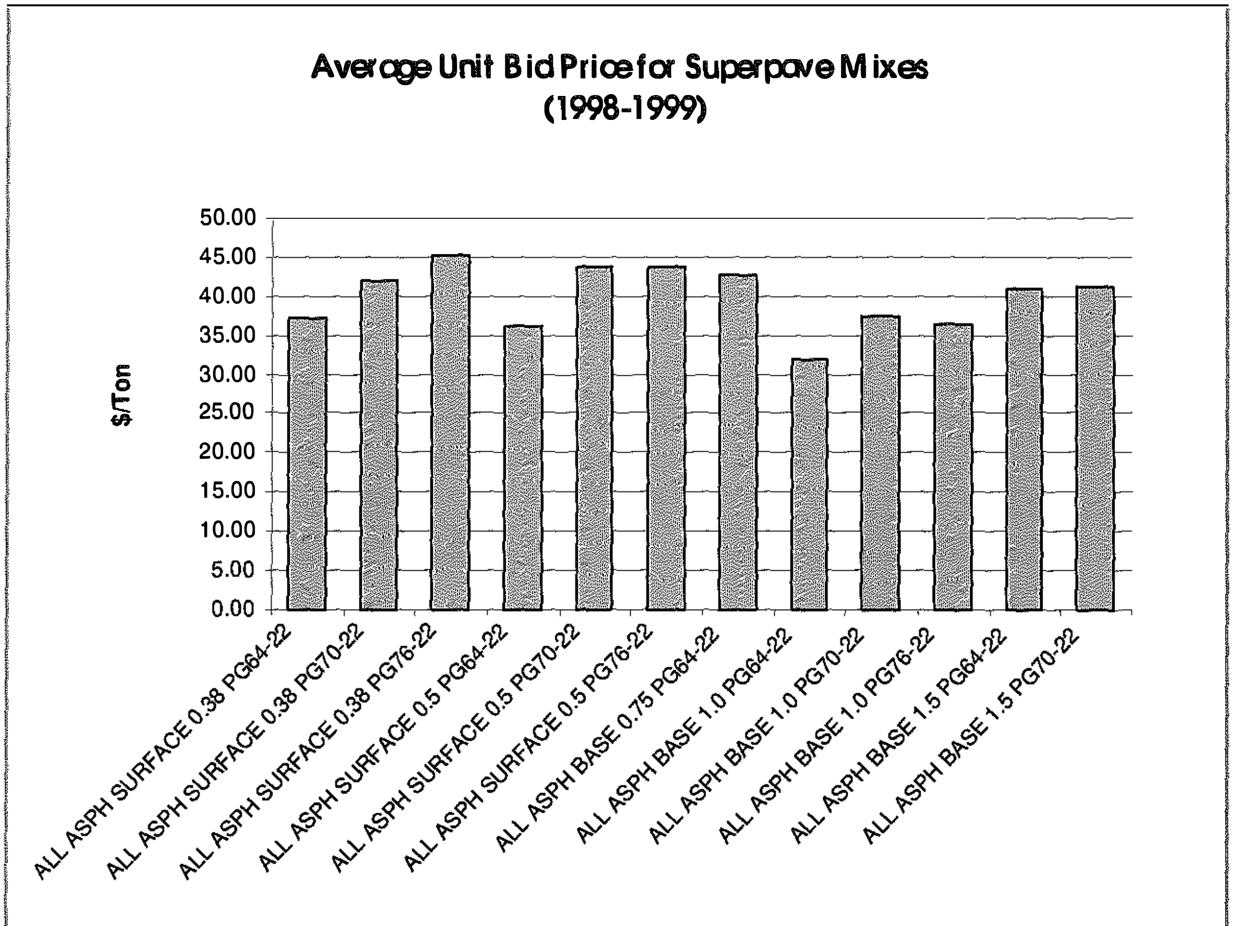

Figure 58. Average Unit Bid Price for Superpave Mixtures Broken Into Binder Grades.

7.1 Superpave and Marshall Unit Cost Versus Total Pavement Cost

Figure 59 shows the unit bid price versus the total pavement cost for Superpave projects in 1998. This figure clearly shows that the unit bid price was not related to the total pavement cost. The majority of the unit bid prices were between 32 and $50 per ton. Figure 60 displays the same information for Marshall mixtures bid in 1997 and 1998. Again, most of the data is between 32 and $50 per ton. However, there was a group of projects clustered between 18 and $27 per ton in 1997. These values may have been bids by one contractor. However, by studying the remainder of the data, it does not appear to be related to inflation.

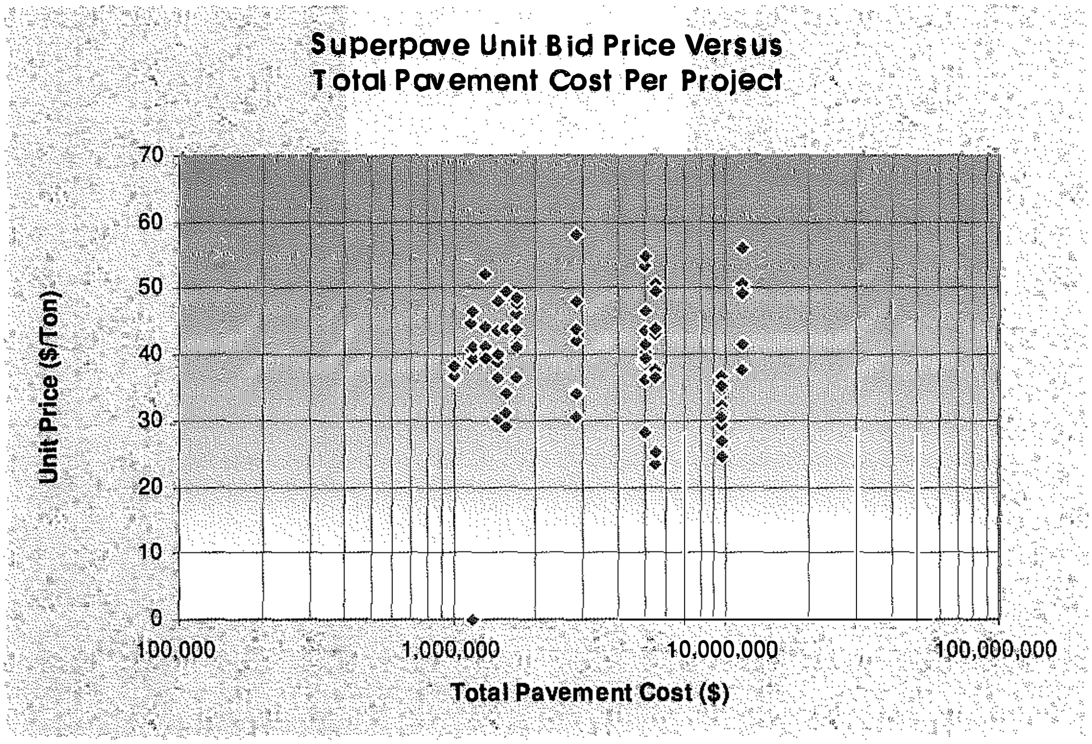

Figure 59. Superpave Unit Bid Price Versus Total Pavement Cost.

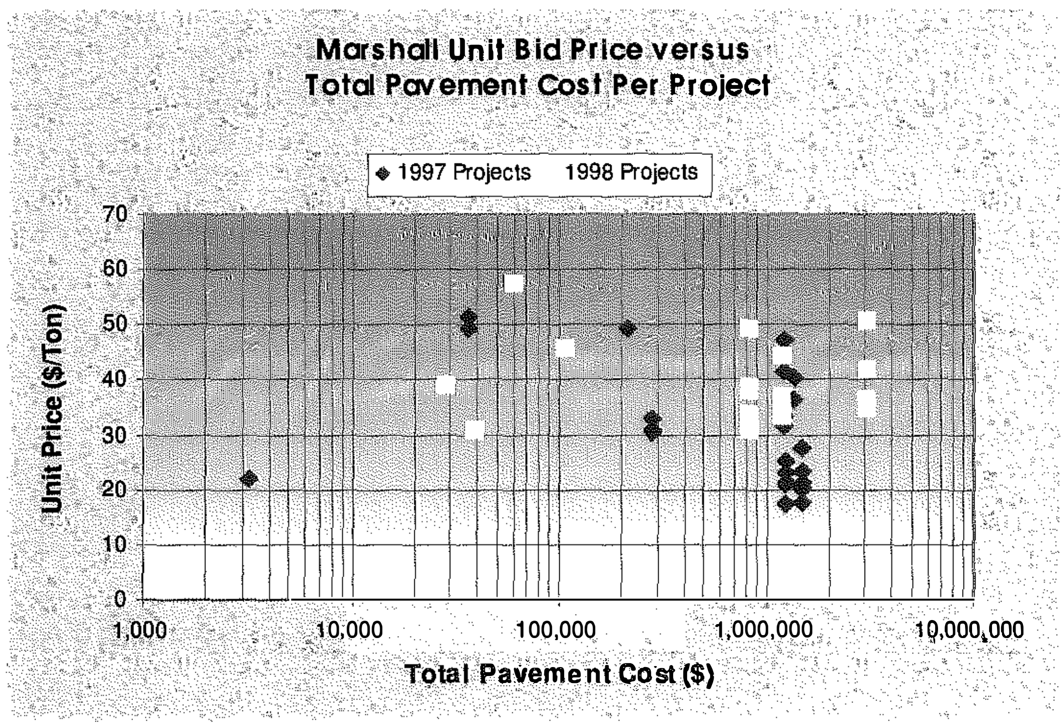

Figure 60. Marshall Unit Bid Price Versus Total Pavement Cost.

8.0 DISCUSSION AND CONCLUSIONS

The Superpave mixtures observed during this study were all designed on the coarse side of the restricted zone. No fine-graded mixtures were placed during the course of this study. Problems observed during construction included low VMA, low TSR, low density, dips, humps, aggregate and thermal segregation, tender zones, and trouble with establishing rolling patterns. The review of national experience with Superpave indicates that most of these problems are also being observed nationwide.

The national survey recommended using heavier rollers to help with the compaction of Superpave mixtures. Data from this study indicated that less compactive effort was required when using two heavy rollers than when using three lighter-weight rollers. Contractors that used two heavy rollers were able to achieve the target density faster and avoid the tender zone (usually occurring between 170 and 280 °F). Information obtained during this study also indicated that mixtures were less likely to move if the underlying surface had been milled, or a leveling course had been placed, prior to the new overlay.

The use of MTV's significantly reduced the amount of aggregate and thermal segregation. The degree of thermal segregation will likely increase with decreasing air temperatures. Further research is needed to evaluate the effects of thermal segregation on short and long-term performance of asphalt pavement.

Mixing temperatures for base mixtures ranged from as low as 300 °F for PG 64-22 binder to as high as 345 °F for PG 76-22 binder. The average lay-down temperature was 20 to 26 degrees lower than the mixing temperature. The rolling temperatures for the base mixtures ranged from as low as 280 °F for PG 64-22 binder to as high as 315 °F for the stiffer PG 70-22 and PG 76-22 binders. The working temperature range appeared to be larger for the softer binders.

The mixing temperatures for the surface mixtures were considerably more variable than for the base mixtures. This variability partially includes the differences in mixing temperatures for the different PG binders. The lay-down temperatures ranged from as low as 275 °F to as high as 340 °F. The lay-down temperatures were below the target temperature for three projects with PG 76-22 binder.

As expected, there was an inverse relationship between VMA and laboratory density. There was a slightly inverse relationship between VMA and core density. The core densities for the base mixtures closely matched the laboratory densities. Most of the surfaces fell well below the line of equality. There appeared to be little relationship between AC and core density.

Performance comparison between Superpave and Marshall mixtures indicates that Superpave mixtures appear to be performing better. The Marshall mixtures appear to be more prone to bleeding, rutting, and other surface distresses. More transverse cracking was noted on the Superpave projects than on the Marshall projects. Cost comparisons indicate that the Superpave mixtures cost about the same as the Marshall mixtures. At this time, it appears that Superpave mixtures may last longer.

The initial ride index for Superpave and Marshall projects appear to be approximately the same.

The Superpave and Marshall projects observed in this study should be evaluated long-term so that long -term performance information may be collected.

APPENDIX A
FIELD CONSTRUCTION DATA

Field Construction Data

Rt. Prefix	Rt. #	Ext	County	Date	Base	Tack	Surface/Base	PG	Thickness (in.)	Distance (miles)	Idle Minimum Time (min)	Idle Maximum Time (min.)	Transfer	Paver	Paver Speed	Hopper Wings
US	421		Trimble	8/27/98	existing AC	SS1H	surface	PG70-28	2	13.5	5	15	truck	pneumatic	36' per min	mostly in
WK	Parkway		Grayson	10/21/98	broken PCC	SS1H	base	PG 70-22	5	15.5	5	10	transfer device	track	10' per min	out
US	23		Pike	9/1/98	existing AC	SS1H	base	PG 76-22	4	12	0	10	truck	pneumatic	36' per min	in
US	421		Trimble	8/31/98	cl2 asph base	SS1H	surface	PG 70-28	1.5	13.5	5	15	truck	pneumatic	36' per min	mostly in
US	68		Logan	9/3/98	existing AC	SS1H	surface	PG 64-22	1.24	1	0	0	transfer device	track		out
US	27		Pulaski	9/8/98	AC base	SS1H	base	PG 64-22	3.5	8	5	15	truck	pneumatic	20' per min	out
KY	550		Knott	9/2/98	existing AC	SS1H	surface	PG 76-22	1.5	20	0	0	truck	pneumatic	46' per min	ls out/rumble
US	31	E	Nelson	9/28/98	existing AC	SS1H	surface	PG 64-22	1.75		5	15	truck	pneumatic	36' per min	out
KY	9		Mason	9/22/98	existing AC	SS1H	surface	PG 64-22	1.5	8	10	15	truck	pneumatic	30' per min	out
US	68		Christian	9/9/98	AC base	SS1H	surface	PG 64-22	1.5	7	0	0	transfer device	track	1 mph	out
KY	52		Estill	9/18/98	existing AC	SS1H	surface	PG 70-22	1.875	8	5	15	truck	pneumatic	1 mph	out
KY	78		Lincoln	9/2/98	existing AC	SS1H	surface	PG 64-22	1.25	23	5	40	truck	pneumatic	1 mph	in
US	27		Campbell	10/2/98	PCC	SS1H	surface	PG 70-22	4	10	0	5	transfer device	track	1 mph	out
KY	16		Kenton	10/26/98	existing AC	SS1H	surface	PG 64-22	1.25	12.1	30	60	truck	pneumatic	35' per min	mostly in
US	23		Pike	10/7/98	existing base	SS1H	base	PG 76-22	4	10	5	10	truck	pneumatic	25' per min	out
US	31	W	Jefferson	10/1/98	AC milled	SS1H	surface	PG 76-22	1	22	5	15	transfer device		30' per min	out
US	68		Todd	10/6/98	dga	none	base	PG 64-22	3	0-1	5	10	transfer device	track	20' per min	in
US	25	E	Knox	8/19/98	existing AC	SS1H	surface	PG76-22	1.5	13	10	15	truck	pneumatic	48' per min	in
US	62		Carlisle	8/10/98	existing AC	SS1H	surface	PG 64-22	1	25	8	16	truck	track	40' per min	in
US	60		Woodford	6/8/98	AC milled	SS1H	surface	PG 64-22	1.56	5			truck	track	1 mph	out
US	62		Marshall	8/18/98	existing AC	SS1H	surface	PG 64-22	1.5	8.5	10	15	truck	track	40' per min	mostly out
I	64		Fayette	7/27/98	existing AC	SS1H	surface	PG 76-22	1.5		5	15	truck	track	1 mph	in
KY	4		Fayette	7/10/98	existing AC	SS1H	surface	PG 76-22	1.5	10	0	0	truck	pneumatic	1 mph	in
US	68		Logan	8/14/98	Dga	none	base	PG 64-22	4.25	1	5	10	transfer device	track	25' per min	out
US	68		Christian	8/11/98	Dga	none	base	PG 64-22	3	10	4	8	transfer device	track	25'-35' per min	in

Field Construction Data

Rt. Prefix	Rt. #	Ext	County	Mix Temp.	Minimum Lay-Down Temp.	Maximum Lay-Down Temp.	Minimum Roll Temp.	Maximum Roll Temp.	# of Rollers
US	421		Trimble	345	318	340	280	280	3
WK	Parkway		Grayson	338	315	320	310	320	2
US	23		Pike	340	300	325	300	325	3
US	421		Trimble	350	290	290	280	280	2
US	68		Logan	315	278	278	278	278	2
US	27		Pulaski	330	305	315	305	315	2
KY	550		Knott	340	300	300	300	300	2
US	31	E	Nelson	307	307	307	295	295	2
KY	9		Mason	335	310	320	310	310	3
US	68		Christian	315	300	310	280	280	2
KY	52		Estill	325	305	310	290	310	3
KY	78		Lincoln	300	275	275	250	285	2
US	27		Campbell	315	300	300	268	268	3
KY	16		Kenton	340	310	320	290	300	2
US	23		Pike	345	320	320	310	320	2
US	31	W	Jefferson	325	280	290	280	295	2
US	68		Todd	300	280	290	280	280	3
US	25	E	Knox	340	340	340	310	330	3
US	62		Carlisle	310	275	300	265	290	3
US	60		Woodford	305	290	290	290	290	3
US	62		Marshall	310	290	290	275	275	3
I	64		Fayette	345	330	330	280	280	3
KY	4		Fayette	340	315	330	290	305	3
US	68		Logan	335	310	310	285	285	2
US	68		Christian	300	310	310	300	305	2

Field Construction Data

Rt. Prefix	Rt. #	Ext	County	Min. # of Roller Passes	Max. # of Roller Passes	Roller 1 Type	Roller 2 Type	Roller 3 Type	Roller 1 Weight (ton)	Roller 2 Weight (ton)	Roller 3 Weight (ton)	Roller 1 Setting	Roller 2 Setting	Roller 3 Setting
US	421		Trimble	10	10	steel drum	steel drum	steel drum	14	12	8	vibratory	vibratory	static
WK	Parkway		Grayson	8	8	steel drum	steel drum		12	11		both	static	
US	23		Pike	9	9	steel drum	steel drum	steel drum	12	10	12	both	static	both
US	421		Trimble	4	4	steel drum	steel drum		14	12		both	static	
US	68		Logan	6	7	steel drum	steel drum		*	*		both	static	
US	27		Pulaski	3	6	steel drum	steel drum		*	*		vibratory	vibratory	
KY	550		Knott	5	6	steel drum	steel drum		12	12		vibratory	both	
US	31	E	Nelson	5	5	steel drum	steel drum		10	*		vibratory	static	
KY	9		Mason	5	6	steel drum	steel drum	steel drum	12	*	12	vibratory	vibratory	static
US	68		Christian	6	7	steel drum	steel drum		10	10		vibratory	static	
KY	52		Estill	6	12	steel drum	steel drum	steel drum	14	12		vibratory	vibratory	static
KY	78		Lincoln	8		steel drum	steel drum		10	10		vibratory	static	
US	27		Campbell	7	8	steel drum	steel drum	steel drum	12	10	10	vibratory	vibratory	static
KY	16		Kenton	8	8	steel drum	steel drum		*	*		static	static	
US	23		Pike	6	6	steel drum	steel drum		12	12		both	vibratory	
US	31	W	Jefferson	7	7	steel drum	steel drum		14	14		vibratory	both	
US	68		Todd	8	8	steel drum	steel drum	steel drum	11	12	12	vibratory	static	static
US	25	E	Knox	10	10	steel drum	steel drum	steel drum	12	12	8	both	both	both
US	62		Carlisle	8	9	steel drum	steel drum	steel drum	14	12	12	static	static	static
US	60		Woodford	5	5	steel drum	steel drum	steel drum	*	*	*	vibratory	vibratory	static
US	62		Marshall	7	7	steel drum	steel drum	steel drum	14	12	12	both	static	static
I	64		Fayette	6	6	steel drum	steel drum	steel drum	15	15	15	vibratory	vibratory	static
KY	4		Fayette	6	6	steel drum	steel drum	steel drum	15	15	15	vibratory	vibratory	static
US	68		Logan	11	11	steel drum	steel drum		12	10		both	static	
US	68		Christian	5	6	steel drum	steel drum		20	10		vibratory	static	

* Data not available

Field Construction Data

Rt. Prefix	Rt. #	Ext	County	Maximum # of Roller 1 Passes (Vibratory)	Maximum # of Roller 1 Passes (Static)	Maximum # of Roller 2 Passes (Vibratory)	Maximum # of Roller 2 Passes (Static)	Comments	Maximum # of Roller 3 Passes (Vibratory)	Maximum # of Roller 3 Passes (Static)	Comments
US	421		Trimble	3	0	4	0		0	3	
WK	Parkway		Grayson	3	1	0	4				
US	23		Pike	2	1	0	2		3	1	
US	421		Trimble	1	1	0	2				
US	68		Logan	2	1	0	3				
US	27		Pulaski	4	0	0	6				
KY	550		Knott	2	0	4	0	after 20-min. wait			
US	31	E	Nelson	3	0	0	2				
KY	9		Mason	1	0	2	0		0	3	
US	68		Christian	3	0	0	4				
KY	52		Estill	4	0	4	0		0	4	
KY	78		Lincoln	4	0	0	4				
US	27		Campbell	2	0	2	0		0	4	
KY	16		Kenton	0	5	0	3				
US	23		Pike	2	1	3	0				
US	31	W	Jefferson	2	0	3	2				
US	68		Todd	3	0	0	2	after 20-min. wait	0	3	after 15-min. wait
US	25	E	Knox	3	1	3	1		1	1	
US	62		Carlisle	0	3	0	3		0	3	
US	60		Woodford	2	0	2	0		0	1	
US	62		Marshall	1	2	0	1		0	3	
I	64		Fayette	*	*	*	*				
KY	4		Fayette	2	0	2	0		0	2	
US	68		Logan	6	1	0	6				
US	68		Christian	3	0	0	3				

* Data not available

Field Construction Data

Rt. Prefix	Rt. #	Ext	County	Minimum Distance Between Paver and Roller 1 (ft.)	Maximum Distance Between Paver and Roller 1 (ft.)	Minimum Distance Between Roller 1 and Roller 2 (ft.)	Maximum Distance Between Roller 1 and Roller 2 (ft.)	Minimum Distance Between Roller 2 and Roller 3 (ft.)	Maximum Distance Between Roller 2 and Roller 3 (ft.)	Roller 1 Problems	Roller 2 Problems	Roller 3 Problems	Segregation	When Open to Traffic
US	421		Trimble	25	25	100	150		528	some shoving			no	as paving moves forward
WK	Parkway		Grayson	50	150	15-20 minutes				some shoving			no	not open to traffic
US	23		Pike	25	25	100	200			some shoving			yes	not open to traffic
US	421		Trimble	100	150	100	300						no	as paving moves forward
US	68		Logan	25	25	10-20 minutes							no	not open to traffic
US	27		Pulaski	25	25	just a few ft							no	not open to traffic
KY	550		Knott	25	25	15-20 minutes				some shoving			no	1.5 hr.
US	31	E	Nelson	100	300						roller tearing pavement		no	as paving moves forward
KY	9		Mason	25	25	200t	300	200	400				no	as paving moves forward
US	68		Christian	25	25	500	500						no	not open to traffic
KY	52		Estill	25	150	200	300	100	1500		had to let mix cool to avoid shoving		no	5 to 7 hr.
KY	78		Lincoln	25	25	25	1000						no	2.5 to 3 hr.
US	27		Campbell	25	25	50	100	100	150				no	3-4hr.
KY	16		Kenton	100	150	10-15 minutes							no	30-40 min.
US	23		Pike	25	25	5-10 minutes apart				some shoving			yes	not open to traffic
US	31	W	Jefferson	100	150								no	not open to traffic until finished
US	68		Todd	25	25	15-20 min. behind #1			10-15 min. behind #2	some shoving			no	not open to traffic
US	25	E	Knox	100	150	together			528				very little	opened at end of day
US	62		Carlisle	100	150	100	150	100	150				no	as paving moves forward
US	60		Woodford	25	25	25	150	1000	1000				no	7-8 hr. at begging, 1-2 hr. at end
US	62		Marshall	100	100	100	150	100	150				very little	as paving moves forward
I	64		Fayette	25	150	50	500	50	500				no	not open to traffic
KY	4		Fayette	25	200	100	100						no	12 hr.
US	68		Logan	200	200	200	200			some shoving on 1st pass			no	not open to traffic
US	68		Christian	100	100	1 hour				some shoving on 1st pass			no	not open to traffic

APPENDIX B
CONSTRUCTION SUMMARIES/ FIELD OBSERVATIONS

SUPERPAVE PROJECT SUMMARIES BY DISTRICT

District 1

US 641, Marshall-Calloway Co.
FD05 079 GR97 0000065
FD05 018 GR97 0000065
Surface
Completed 9/97

This project was completed prior to the initialization of this study.

KTC personnel inspected the project on April 8, 1999. Bleeding was observed in numerous spots throughout the project.

US 62, Marshall Co.
FD05 079 0062 000-008
Surface
08-18-98

KTC personnel visited the US 62 project on August 18, 1998. No apparent problems were occurring with the mixture. The inspector and the foreman on the job both indicated that there were no unusual problems. The same crew had just finished a Superpave resurfacing job on US 62 in Carlisle Co. KTC personnel revisited the job on September 17, 1999 to observe short-term performance. In several locations throughout the project, several dips were observed going across the mat. The dips were fairly evenly spaced. Rutting measurements were also taken throughout the project. The maximum rut depth was 1/8 of an inch which had occurred at eight out of 32 locations. The rutting was more significant than what had been observed on the other Superpave projects.

Comments: It is unclear at this time why the horizontal dips had occurred or why the pavement is rutting more than the other projects. This project should be closely monitored.

Department Comments: Air voids and VMA were slightly low during production, but the contractor elected to not adjust the mixture very much in order to achieve density on this particular highway.

KTC personnel returned to this project on April 8, 1999. More rutting was observed. Transverse cracks were observed in the dips that were documented in 1998.

US 62, Carlisle Co.
FD05 020 062 000-013
Surface
08-10-98

KTC personnel revisited the project on August 10, 1998. Nothing unusual was observed. The foreman and inspector on the project had not encountered any problems with the mixture. The foreman indicated that, despite their initial misgiving, they found the Superpave mixture to be no more difficult to work with than most others. The site was revisited on September 17, 1998, and there was no significant rutting.

Department Comments: The volumetrics were reasonably consistent for this project. The contractor had some core density values which were low on percent of solid density. This project was a rural highway with low traffic.

KTC personnel revisited the site on May 11, 1999. Rutting was observed throughout the project. The average rut depth was 1/16 of an inch. Transverse cracking was observed every 10 to 50 ft. throughout the project. Many of the cracks had a transverse bump associated with them.

District 2

US 68, Christian Co.
FD04 024 0068 001-006
Base and Surface
8/98

KTC personnel initially observed the placement of the base course on August 11, 1998. The pavement looked good, and both the foreman and inspector said they had not encountered any unusual problems. They both agreed that the use of a MTV had helped to overcome problems with segregation of the coarse base mixture.

A few days later, they started to lay a binder course but were soon stopped because the binder mixture failed the TSR test.

KTC personnel tested the base and the binder course with the Falling Weight Deflectometer in late August.

On August 15, 1998, KTC personnel visited the new Superpave site on US 68 in Christian County. The contractor had been placing binder course on top of base course but was shut down because the base material had failed the TSR test. Division of Materials personnel indicated that they had run the TSR test on the base material, and it rated only 55 percent rather than 80 percent needed to pass. The binder material had also failed. The binder tested 77 percent (3 percent less than passing the 80 percent lower limit). Approximately one mile of the failed base course had been placed and about two-thirds of it had been covered with the failed binder course.

Department Comments: In the beginning, volumetrics were inconsistent. Achieving density was a problem on the first day after the mixture was adjusted to raise air voids and VMA. The majority of the second day, the mixture exhibited low VMA and low density. After continuous testing and adjustments, the VMA and density began to climb into the acceptable range. The AC was lowered from 4.7 percent to 4.4 percent after the first two sets of tests. Slight adjustments in gradation were also made.

US 68, Christian Co.
ED 7106-001S JB01 024 0068 013-019
Base and Surface
8-11-98

Department Comments: Problems were encountered during the mixture design phase regarding TSR specimens. The contractor attempted numerous combinations before obtaining a set of passing test results. The final combination consisted of 10% recycled-asphalt pavement (RAP), washed aggregates, and 1.0 percent liquid anti-stripping additive to achieve a TSR value of 87 percent. The VFA was 79.8 percent. The contractor was to adjust accordingly during production.

KY 56, Union Co.
FD05 113 0056 013-024
Surface
7-31-98

On July 31, 1998, KTC personnel went to Union Co. to observe the Superpave project being placed on KY 56. The asphalt had a coarse appearance. A one-inch Superpave asphalt mixture was being placed over an existing asphalt pavement. From conversations with the Resident Engineer on the job, the job was going very well. At that time, based on nuclear density gauge readings they were getting density of 92 to 95 percent. However, when the cores were taken and bulk specific gravities performed showed densities of only 87 to 92 percent.

The contractor added 0.1 percent more asphalt binder to the mixture and made some changes in the rolling pattern to improve densities. However, they were still not getting densities as high as they wanted. The contractor was using an eight-ton roller right behind the paver and then making two and a half passes vibrating. A ten-ton roller followed close behind and made two passes without vibrating. They were still experimenting with roller patterns to get the density that they wanted. The next day, on the advice of personnel from the Division of Materials, another 0.1 percent asphalt binder and some fines were added to the mixture. The last cores taken showed densities of 93.2 to 95.1 percent

It appears that the nuclear density gauge may have been reading the scratch course below the new surface.

Department Comments: The design AC was 5.6 percent. Air voids, VMA, and AC were fairly consistent for this mixture during production. The density was difficult to achieve. This mixture, by weight, is 67 percent fine aggregate. Limestone #9-M's and #11's make up about 63 percent of the total blend by design. Limestone #11's are classified as fine aggregate, but some sources such as this one are extremely clean. They were free of dust and very fine particles. The pavement appeared to be very coarse by visual inspection. Dust was added at the plant on the last day of production along with another 0.1-percent of asphalt binder. The density of the cores increased to between a 100 and 105-percent pay factor. This extra asphalt binder was the second increase for a total of 0.2 percent above the original design AC (5.6 to 5.8%). The original adjustment was adding 0.1 percent asphalt binder, but this effort alone did not result in the desired density.

Adding the dust (1 percent) resulted in the air voids dropping slightly below a 100-percent pay value.

VMA was acceptable. Another possible solution would be to adjust the fine-bin percentage for the batch plant along with the additional asphalt binder in order to "fill in" around the coarse texture that was present in this mixture. This action would have possibly made the mixture more compactable, and the air voids would have remained in specification.

This project was a small one, and the contractor elected not to take cores during the set-up period for a core-to-gauge correlation. The gauge indicated a high density, but the acceptance cores were considerably lower, resulting in a deduction of payment for density for all but the last sublot of material. The cores were repeatedly tested by various personnel, and other methods and were concluded to represent the original values. The Division of Materials highly recommends that cores be taken as quickly as possible at the beginning of the project for a comparison to the gauge. It is possible that the gauge used on this project may have been reading into the tighter scratch course placed immediately below the final surface.

KTC personnel revisited the project on May 12, 1999. Rutting measurements were taken throughout the project. Little to no rutting had occurred. A maximum of 1/16 of an inch was observed. Approximately 60 to70 transverse cracks were noted.

District 3

US 68, Logan Co.
ED 7109 01S
Base & Surface
9-03-98

KTC personnel visited this site twice, once when they were placing base and once when placing surface. The only problem observed was that when the contractor was placing the base, in places, the subgrade was weak and the MTV cut deep ruts in front of the paver. No problems were observed with the surface course. FWD tests were conducted on the finished pavement. The mixture was tender. The finish roller was approximately one hour behind the initial breakdown and intermediate roller.

Department Comments: A "shuttle buggy" (MTV) was utilized on the driving lanes. No segregation occurred with the use of the MTV. The base mixture showed signs of having a "tender zone." The intermediate and finish rolling were held back after the initial breakdown roller made its passes until the mat cooled enough so that the mat did not "move under the roller."

The original plans specified a 12.5-mm binder course. Due to subgrade concerns, the binder course was deleted, and the 19-mm Class I base course was increased from 152.4 mm in thickness to 304.8 mm. The revised quantity of base material was approximately 94,500 tons.

During the set-up period for the base mixture, the VMA was low. The contractor lowered the washed limestone sand from 45 to 35 percent and added 10 percent siltstone sand. The change helped to increase the VMA on the plant-produced mixture. Also, the AC was increased from 4.0 to 4.2 percent due to the siltstone sand bulking the mixture open. The increase in AC closed the air voids to the 4 percent range and aided in obtaining density. The AC was decreased during the adjustment period from the approved 5.6 to 5.3 percent. Also, the natural sand was decreased, and the siltstone sand increased, to increase the VMA. The increase in siltstone sand also increased the fine-aggregate-angularity value.

KTC personnel returned to the site on May 27, 1999. No visible distress was observed. Rutting was very slight, if any, and less than 1/16 of an inch.

__District 4__

US 31E, Nelson Co.
FD05 090 031E 015-021
Surface
9-28-98

On this project, the contractor was having problems with rolling. The foreman said that the problem might have to do with the existing surface. According to the foreman, they had little problem where they had put down a leveling course, but on other sections, the new pavement wanted to push, move, and in some cases, break. The contractor only used two rollers, and the second roller was kept a considerable distance behind the first roller. The foreman said that the second roller often fell far behind because there was a tender zone in the compaction temperature and the roller had to wait for the pavement to cool before he could finish rolling it.

When KTC personnel revisited the site, it appeared that rutting was more significant than on the other Superpave projects and that the pavement seemed a little rough.

Department Comments: The mixture was released with 1.0 percent liquid anti-stripping additive and adjusted to 0.5 percent in the field after the start of production.

KTC personnel returned to the project on June 1, 1999. Rutting of 1/16 of an inch was observed at most locations, and the maximum rut depth observed was 1/8 of an inch. Several bumps and dips were observed in the road surface.

__District 5__

US 421, Trimble Co.
FD05 112 0421 000-007
Base & Surface
08-27-98

On August 27, 1998, the quality control person on this job indicated that she had to change the rolling pattern as the conditions changed. She had the third roller on the job working with her and would change the rolling pattern based on density readings. There was some question about the temperature of the mixture when it arrived at the job site, but it may have been based on faulty readings of the contractor's thermometer. The foreman on the job said that the mixture was arriving at the job too hot and that made it difficult to work because it was "sticky." However, the Department inspector and the people at the plant and lab said that the mix temperature was ten to twenty degrees lower than the foreman's readings. Readings taken by KTC personnel closely matched those taken by the Department inspector.

Personnel from KTC revisited the site two days later when the contractor was placing the surface course. The quality control person told KTC personnel that she was having problems with the density. She indicated that the density readings were erratic and in some cases too high, 96 to 97 percent. Also, the readings varied from as low as the "mid-eighties" to as high as the "upper-nineties" in the same lane. The quality control person indicated that she thought that the problem was with the new operator on the first roller. According to her, the operator would not closely follow her instructions for a consistent rolling pattern.

Department Comments: No break-and-seat treatment was performed on existing pavement prior to the placement of the base and surface courses.

KTC personnel returned to the project on May 20, 1999. The project appeared to be performing well. Rutting was infrequent with a maximum of 1/16 of an inch.

KY 676, Franklin Co.
FD06 037 0676 001-006
Surface
Completed 11/95

No construction data were gathered since the project was completed prior to the initialization of the study.

KTC personnel visited the site on April 20, 1999. Longitudinal cracking was observed in the wheelpaths in several locations.

US 60, Jefferson Co.
FD05 056 0060 007-012
Surface
Completed 9/97

No construction data were gathered since the project was completed prior to the initialization of the study.

I-64, Shelby-Franklin Co.
FD39 121 DW97 0000027
Surface
Completed 7/97

No construction data were gathered since the project was completed prior to the initialization of the study.

US 31W, Jefferson Co
FD05 056 GR98 0000055
Surface
10-01-98

There were no problems with this project. The contractor only used two rollers and had no problems getting density. The foreman indicated the company had a lot of experience placing Superpave mixtures in Indiana and that he had found they had no problem with density as long as they used two very heavy rollers.

KTC personnel returned to this project on January 13, 1999. Rutting was minimal with 1/16 of an inch in several spots and a maximum of 1/8 of an inch. Many transverse cracks were noted. Possibly, the reflective cracks were from the old concrete pavement.

District 6

KY 16, Kenton Co.
FD05 059 0016 003-010
Surface
10-26-98

The asphalt plant personnel indicated that they were having problems with the VMA. The plant had made changes in the mix hoping to correct the VMA. They had already made two changes that had not corrected the problem.

KTC returned to the project on May 28, 1999. Rutting was noticeable throughout the project, ranging from 1/16 to 1/8 of an inch. Rutting of 5/16 of an inch was observed in front of a new subdivision.Transverse cracks were observed throughout the project. Bleeding was also observed in a few areas.

US 27, Campbell Co.
FD06 019 0027 010-016
Base & Surface
10-2-98

No problems were observed.

KTC personnel returned to the project on May 28, 1999 for rut measurements and visual inspection. The pavement appeared to be in good shape. Traffic at the time of inspection was too heavy to take rut measurements.

I-75, Boone Co.
IM STPR 75-7 (110) 168
Base & Surface
Under Construction

This project was not visited by KTC personnel.

__District 7__

US 127B
ED 7214-02S, JC01 084 127B 000-005
Base & Surface
Completed 6/97

No construction data were gathered since the project was completed prior to the initialization of the study.

I-64, Fayette Co.
FD52 034 0418 000-003
Base & Surface

The only problem that was observed was on the first 300 to 500 ft. of pavement. The pavement was experiencing transverse humps and cracks approximately every 50 ft. A thin transition wedge was being placed at this location.

KTC personnel returned to the project on February 3, 1999. Rutting was minimal, mostly 1/16 of an inch with a maximum of 1/8 inch. Transverse cracks were observed at the start of the project, and a few small spots of bleeding were also observed.

KY 4, Fayette Co.
FD05 034 GR98 0000007
Surface
7-10-98

The pavement was placed at night and appeared to go down without any problems. After looking at the pavement a day later, it was clear that there were some faint transverse humps in the new surface. It appears that the humps were roller-related.

State Comments: The contractor complained of density problems.

KTC personnel revisited the project on June 3, 1999. Rutting was minimal, mostly 1/16 of an inch with a maximum of 1/8 of an inch. A visual inspection was conducted on June 21, 1999. Bleeding was observed in two locations.

US 60, Woodford Co.
FD05 120 0060 000-009
Surface
6-10-98

During the initial lay-down of the mixture, transverse humps formed in the pavement. It appeared that the humps were coming from the underlying concrete pavement. It also appeared that the "band aids" placed over the concrete joints were rising up under the old asphalt surface due to the heat generated from the new surface mixture. The asphalt binder in the mixture was changed from a PG 76-22 to a PG 64-22.

Department Comments: The project started with a PG 76-22 binder. The higher mixing and compaction temperatures required for this type of binder were causing "bumps" in the finished mat. It is believed that the underlying geotextile material placed over the joints in the concrete pavement in 1982 was being heated and allowed the fabric to delaminate from the concrete. Thus, a bump occurred across the entire lane at each joint. The first 700 tons of mixture were placed prior to stopping production to determine the measures to take in correcting this problem. After much discussion, it was decided to change the binder type to PG 64-22, therefore allowing a lower mixing and compaction temperature. This change did solve the problem throughout the remainder of the project.

Also, to improve the ride quality on the project, no significant increase in tonnage was allowed with this change. Instead, the 40-mm riding course by design was adjusted to approximately 25 mm with an approximate 12.5-mm scratch course. This change did not appear to have an impact on the contractor's ability to achieve acceptable density values on the final riding surface.

No segregation was noted on this project.

KTC personnel revisited the project on June 2,1999. The pavement had rutted 1/16 of an inch at most sites with a maximum rut depth of 3/16 of an inch. Transverse cracking was abundant throughout the project.

District 8

US 27, Pulaski Co.
FD04 100 0027
Base & Surface
9-08-98

On this project, a third lane is being added to the existing two lanes. Only the third lane is completely Superpave. The base courses on the new lane and the existing lanes are all that were placed this year. The surface will not be placed until next year. The only problem observed was a slight amount of segregation of the mixture as it was placed. Although the segregation was slight, it could be a problem because the mat will be exposed all winter.

Department Comments: Test results have been fairly consistent. Slight segregation was noticed, but the pavement was mostly uniform. Suggestions were given by Division of Materials personnel on the proper loading of the trucks at the plant.

KY 78, Lincoln Co.
FD05 069 0078 002-012
Surface
9-2-98

No problems were observed.

Department Comments: There was a problem during the set-up period with low air voids and VMA. The contractor made adjustments by lowering the AC by 0.2 percent and adjusting the gradation. The mixture ran consistently after this point, and the density was easy to achieve.

KTC personnel returned to the project on May 19, 1999. The pavement appeared to be in good shape. Rutting was observed at half of the sites that were measured. Most of the ruts were 1/16 of an inch, with a maximum rut depth of 1/8 of an inch.

District 9

US 68, Mason Co.
FD05 081 GR97 0000052
Surface
Completed 9/97

No construction data were gathered since the project was completed prior to the initialization of the study.

KY 9, Mason Co.
FD05 081 GR98 0000081
Surface
9-22-98

There were no apparent problems with this job. The foreman on the job said that after some initial problem with determining a satisfactory rolling pattern, things had gone very smoothly.

Department Comments: In the mix design phase of this project, a discrepancy was noted between the contractor and the Division of Materials Central Laboratory regarding the aggregate specific gravity of the dolomite sand which comprised 23 percent of the total mixture. After a comparison test was completed simultaneously by the contractor's laboratory and the Materials Central Laboratory on the dolomite sand, a common value was reached. The resulting calculations from both parties yielded an average VMA of 14.0 which meets the specified criteria for production.

In the field, the mixture started out with high air voids and VMA. Adjustments had to be made to achieve proper volumetrics and density. Production of the mixture was not consistent. Materials appeared to vary from the stockpiles which accounted for variations in test results without changes in the job mix formula. Overall, the results were within specifications.

KTC returned to this project on June 3, 1999 for rutting measurements and visual inspection. Rutting was minimal with 1/16 of an inch in most areas. Bleeding was observed in two areas.

KY 8, Lewis Co.
FD05 068 0008 028-037 010H
Surface
Completed 7-98

Department Comments: The mixture appeared tender on the roadway.

KTC personnel revisited the project on June 3, 1999. Approximately 1/16 of an inch of rutting had occurred throughout the project, with 1/8 of an inch being the maximum rut depth that was observed. Several transverse cracks were observed around Milepoint 29.9.

US 23, Boyd Co.
FD05 010 0023 003-011
Surface
Completed 9-98

Department Comments: During the set-up period, the mixture was low on air voids. Adjustments were made in gradation that allowed the mixture to remain consistent for the remainder of production on the project. Another problem was the tender zone. The mixture appeared to shove or push under compaction. Roller patterns were adjusted; mix temperature at the plant was slightly lowered, and attempts were made to achieve density while temperatures were on the higher end, above the tender zone. When it appeared the mixture started moving again, roller operators were instructed to "hold back a little" to allow the mixture to cool slightly and then resume compaction. After these corrections, the tender zone was not a problem.

KTC personnel revisited the project on May 14, 1999. Rutting was minimal, mostly 1/16 of an inch, with a maximum of 3/16 of an inch. Small spots of bleeding and transverse cracking were observed in one location. Water was observed coming up through the pavement in two areas.

District 10

KY 52, Estill Co.
FD05 033 0052 000-004
Surface
9-18-98

The mix appeared to be very tender. The second and third rollers were pushing the mix. The second and third rollers had to be kept off the mat until it cooled down.

Department Comments: During the set-up period, several cold-feed adjustments were made to try to increase the air voids and VMA. The contractor had on hand a coarse, crushed limestone sand which had a large portion of #11- type material. Therefore, the coarse sand was increased, which in turn increased the air voids and VMA. Also, this increase in angular materials in the mixture made the N-initial value go down. This phenomenon was an indicator that the mix may be a little harder to compact on the roadway, which it was slightly. This mixture exhibited a slight tender zone; therefore, the intermediate and finish roller were held back until the mixture cooled somewhat after the initial breakdown roller made its vibratory passes.

KTC personnel returned to the project on June 4, 1999. The pavement appeared to be performing well. Rutting was limited with a maximum rut depth of 1/16 of an inch.

__District 11__

US 25E, Bell
FD05 007 025E 006-012
Surface
Completed 8/98

This site was not visited during construction.

US 25E, Knox Co.
FD05 061 025E 014-022
Surface
Completed 9/98

There appeared to be problems with a tender zone in the mat. The superintendent on the job complained that the mix was coming to the job too hot. However, personnel at the plant disputed the field temperatures.

KTC personnel revisited the site on May 24, 1999. Most sites had no rutting. The maximum rut measured was 1/16 of an inch. Water was observed coming through the pavement at the centerline in some isolated areas. Bleeding was observed in one area, and the pavement was slightly sunken there.

__District 12__

KY 550, Knott Co.
FD05 060 0550 004-010
Surface
9-02-98

No problems were observed on this project. The foreman on this job said that they had some problems with density at the start, but they had worked them out. He said that the quality control person worked closely with the second roller to change the rolling pattern as needed.

KTC personnel returned to the project on May 21, 1999. Most sites had 1/16 of an inch of rutting with a maximum rut depth of 1/8 of an inch. Longitudinal cracks were observed in two areas at the outside edge of the lane.

US 23, Pike Co.
FD39 098 0023 006-015
Base
09-01-98

On this paving job, the only problem observed was a significant amount of segregation of the base mixture as it was placed. The mixture appeared to be a large-stone mix and, in many places, these stones seemed to segregate to the middle of the lane. Other than this segregation, everything seemed to go well. According to the foreman and the quality control person, they had no problem with the placing of the mixture or achieving the target density.

Department Comments: The project, in general, seems to have many areas with more than usual segregation.

KTC personnel revisited the project on May 13, 1999. The project appeared to be in good condition. Rutting was minimal with 1/16 of an inch and a maximum of 1/8 of an inch. Water was observed pumping up through the pavement at the centerline between Milepoints 12.7 and 12.85. A base failure was observed in the northbound, outside lane.

US 23, Pike Co.
FD04 098 0023 000-005
Base
10-07-98

Segregation occurred in several areas throughout the project in the base course. This was a larger stone mixture as on the reconstructed section of US 23, and like it, the mixture showed some segregation (although not as bad). The inspectors said they had problems with segregation from the start, but they had taken steps to minimize them. In this case, rather than the stones segregating to the middle of the paved lane, the main problem was with segregation at the end of each truck load.

MARSHALL PROJECT SUMMARIES BY DISTRICT

District 1

US 641N, Marshall Co.
MP 7 - MP 9
Paved 1997

KTC personnel visited this site on May 11, 1999 to perform a visual survey and collect rutting measurements. This site is one direction of a divided street that runs one-way through the town of Benton. There was considerable bleeding. There were also a lot of transverse cracks and one area where there were several potholes that had been patched. Rut depths ranged from 1/16 of an inch to as much as 3/16 of an inch.

US 641S, Marshall Co.
MP 8 - MP 10
Paved 1998

KTC personnel visited this site on May 11, 1999 to perform a visual survey and collect rutting measurements. This site is the opposite direction of the project above. This site looks much better than US 641N. Rutting was minimal with a maximum of 1/16 of an inch. There were no transverse cracks or areas of bleeding.

US 45, McCracken Co.
MP 8 - MP 9
Paved 1997

KTC personnel visited this site on May 11, 1999 to perform a visual survey and collect rutting measurements. This site has very heavy traffic as it is approximately 1.5 miles from the Interstate toward town. Rutting was above average. Maximum rutting was 5/16 of an inch with many other areas showing 3/16 to 1/4 of an inch. There were also many transverse cracks (many all the way across the road).

District 2

US 60, Daviess Co.
MP 16 - MP 24
Paved 1997

KTC personnel visited this site on May 12, 1999 to perform a visual survey and collect rutting measurements. Most rutting was approximately 1/16 of an inch with a few measurements of 1/8 of an inch. Two locations at the start of the project measured 3/16 of an inch. There were several small spots of bleeding but no large spots or cracking. Overall; the project looked good.

US 60, Union Co.
MP 19 - MP 21
Paved 1997

KTC personnel visited this site on May 12, 1999. This site is located in front of an industrial park and may have heavy truck traffic. Rutting was above average, with several sites measuring 3/16 to 5/16 of an inch. The remainder of the sites measured 1/8 to 1/16 of an inch. There were many transverse cracks spaced approximately 25 to 50 ft. apart. Some of the cracks were as close as 10 ft. apart. Some of the cracks ran just across the turn lanes, but many ran across the entire road. There were also a few spots of bleeding, but they were not large or widespread.

WK Pkwy, Muhlenberg Co.
MP 46 - MP 52
Paved 1998

KTC personnel went to this on site May 7, 1999 to conduct a visual survey and collect rutting measurements. This site looked good overall. There were a few small areas of bleeding. One area was 18 to 24 in. wide, but everything else was much smaller. Rutting was minimal with a maximum rut of 1/16 of an inch.

District 4

WK Pkwy., Grayson Co.
MP 100 - MP 104
Paved 1998

KTC personnel visited the site on May 3, 1999. Overall, this site looked very good. There was almost no rutting with a maximum of 1/16 of an inch in a few locations. There was some bleeding near a construction joint. The only unusual aspect about the pavement was that, in places, the surface looked very closed or "tight." From a distance, these areas looked as if they were wet but were not.

District 7

KY 4, Fayette Co.
MP 2 - MP 9
Paved 1997

KTC personnel visited this site on June 3, 1999 to collect rut measurements and returned on June 21, 1999 to perform a visual survey. Rutting was minimal with a maximum of 1/8 of an inch. There were a few areas of bleeding and two locations where potholes had been patched. There were also a few locations where the pavement was breaking up and potholes were starting to form.

District 10

KY 15, Perry Co.
MP 21 - MP 22
Paved 1997

KTC personnel visited this site on May 5, 1999. If this site was repaved in 1997, it's not apparent. There is no clear start or end of new pavement. Rutting was mostly 1/16 to 1/8 of an inch, but 5/16 of an inch was measured in two locations and 3/16 of an in one other location. There were many longitudinal cracks in the wheelpaths and many transverse cracks. Toward the end of the site, there was a patch across the northbound lane.

District 11

I 75, Whitley/Laurel Co.
MP 24 - MP 29
Paved 1997

KTC personnel visited this site on May 5, 1999 to perform a visual survey. No rutting measurements were made because of heavy traffic. In the southbound lane, there were many areas of bleeding in the wheelpaths. Most were several feet long, and the pavement looked to be sunken. On the northbound side, there were several small areas of bleeding, but no large areas.

District 12

US 119, Pike Co.
MP 9 - MP 12
Paved June 16, 1998

KTC personnel visited this site on May 13, 1999 to conduct a visual survey and collect rutting measurements. Rutting was more than average. Maximum rutting was 5/16 of an inch, and most spots measured 1/8 of an inch. There were several areas of bleeding (most small). No transverse cracks were seen, but there were several longitudinal cracks along the edge of the pavement.

US 23, Pike Co.
MP 21 - MP 23
Paved 1998

KTC personnel visited this site on May 13, 1999. The site looked very good overall. There were a few small locations of bleeding and one transverse crack. Rutting was minimal with a maximum of 1/16 of an inch.

US 23, Lawrence Co.
MP 18 - MP 24
Paved 1998

KTC personnel visited this site on May 14, 1999. Rutting was minimal, mostly 1/16 of an inch, with a maximum of 1/8 of an inch. There were a few small spots of bleeding, but overall, this site looked very good.

I-64, Fayette Co.
MP 84 - MP 91
Paved 1997

KTC personnel visited this site on May 6, 1999 to perform a visual survey. No rutting measurements were made because of heavy traffic. There were many small spots of bleeding mostly one to three inches in size. Overall, the site looked good.

APPENDIX C
LABORATORY DATA

DISTRICT 2

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 113 0056 013-024	UNION	56	Superpave 3/8"	PG64-22	1	7/29/98									
Sublot 1							5.6	2.485	4.6	15.7	147.9	..		0.063	NO DATA
Sublot 2							5.6	2.480	4.8	16.1	147.3	139.0	7/31/98	0.063	NO DATA
Sublot 3							5.6	2.479	4.9	16.2	147.1	139.6	7/31/98	0.063	NO DATA
Sublot 4							5.6	2.482	5.1	16.3	147.1	138.4	7/31/98	0.063	NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 1130056 013-024	UNION	56	Superpave 3/8"	PG64-22	2	7/31/98									
Sublot 1							5.7	2.481	4.7	16.1	147.6	140.4	8/1/98	0.063	NO DATA
Sublot 2							5.8	2.469	2.9	15.0	149.6	144.5	8/3/98	0.063	NO DATA
Sublot 3							6.0	2.469	2.9	15.2	149.6	144.5	8/3/98	0.063	NO DATA

DISTRICT 4

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 090 031E 015-021	NELSON	31 E	SUPERPAVE 3/8"	PG64-22	1	9/28-30/98									
Sublot 1							6.1	2.483	4.1	16.1	148.9	146.7	9/29/98	0.08	98
Sublot2							6.1	2.483	4.0	16.1	149.0	146.7	9/29/98	0.08	98
Sublot 3							6.1	2.485	3.9	15.9	149.3	143.7	9/30/98	0.08	98
Sublot 4							6.1	2.484	4.1	16.2	148.8	143.7	10/2/98	0.08	98

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 090 031E 015-021	NELSON	31 E	SUPERPAVE 3/8"	PG64-22	2	9/30-10/1/98									
Sublot 1							6.1	2.484	4.0	16.1	149.1	144.5	10/1/99	0.08	98
Sublot 2							6.0	2.486	4.0	15.9	149.2	144.5	10/1/99	0.08	98
Sublot 3							6.4	2.471	3.1	16.0	149.6	144.1	10/2/99	0.08	98
Sublot 4															

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD06 043 9001 091-096	GRAYSON	9001	SUPERPAVE 1"	PG70-22	1	10/27/98									
Sublot 1							4.0	2.531	4.5	12.8	151.1	149.3	11/16/98		NO DATA
Sublot 2							4.0	2.523	4.4	12.9	150.8	150.0	11/24/98		NO DATA
Sublot 3							4.0	2.526	4.5	12.9	150.8	150.6	11/24/98		NO DATA
Sublot 4							4.1	2.519	3.9	12.7	151.4	148.59	11/25/98		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD06 043 9001 091-096	GRAYSON	9001	SUPERPAVE 1"	PG70-22	2	11/21/98									
Sublot 1							4.1	2.521	3.6	12.4	151.8	149.4	11/26/98		NO DATA
Sublot 2							4.0	2.524	3.8	12.3	151.8	149.9	11/27/98		NO DATA
Sublot 3							4.2	2.515	3.5	12.5	151.8	150.0	11/27/98		NO DATA
Sublot 4							4.2	2.515	3.5	12.5	151.8	149.1	11/27/98		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD06 043 9001 091-096	GRAYSON	9001	SUPERPAVE 1"	PG70-22	3	11/24/98									
Sublot 1							3.9	2.530	4.1	12.3	151.6	148.8	11/25/98		NO DATA
Sublot 2							4.1	2.520	3.9	12.6	151.4	150.0	11/27/98		NO DATA
Sublot 3							3.9	2.522	4.0	12.5	151.3	149.1	..		NO DATA
Sublot 4							4.0	2.523	3.9	12.5	151.6	..	..		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD06 043 9001 091-096	GRAYSON	9001	SUPERPAVE 1"	PG64-22	1	10/21/98									
Sublot 1							3.5	2.543	5.2	12.5	150.6	153.1	10/27/98		NO DATA
Sublot 2							3.8	2.520	3.6	12.1	151.8	147.1	10/23/98		NO DATA
Sublot 3							4.0	2.530	4.0	12.3	151.8	147.5	10/24/98		NO DATA
Sublot 4							4.0	2.522	4.1	12.7	151.1	146.8	10/26/98		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD06 043 9001 091-096	GRAYSON	9001	SUPERPAVE 1"	PG64-22	2	10/23/98									
Sublot 1							4.3	2.524	4.1	12.8	151.3	147.0	10/26/98		NO DATA
Sublot 2							3.9	2.529	4.6	12.7	151.1	147.5	10/26/98		NO DATA
Sublot 3							4.0	2.526	3.8	12.2	151.5	147.6	10/27/98		NO DATA
Sublot 4							3.8	2.531	4.4	12.5	151.3	147.6	10/28/98		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD06 043 9001 091-096	GRAYSON	9001	SUPERPAVE 1"	PG64-22	3	10/27/98									
Sublot 1							3.8	2.532	4.4	12.4	151.4	150.0	11/11/98		NO DATA
Sublot 2							4.1	2.519	3.7	12.5	151.4	148.2	11/12/98		NO DATA
Sublot 3							3.9	2.529	4.4	12.6	151.3	148.8	11/13/98		NO DATA
Sublot 4							4.0	2.526	3.7	12.1	151.5	148.7	11/14/98		NO DATA

DISTRICT 5

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 112 0421 000-007	TRIMBLE	421	SUPERPAVE 3/8"	PG70-28	1	8/31/98									
Sublot 1							5.9	2.464	4.4	15.2	147.2	143.2	9/1/98	0.063	52
Sublot 2							5.9	2.465	4.1	15.0	147.8	143.3	9/2/98	0.063	52
Sublot 3							6.3	2.446	2.7	14.8	148.7	140.3	9/3/98	0.063	52
Sublot 4							5.8	2.470	5.7	16.2	146.5	141.8	9/4/98	0.063	52

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 112 0421 000-007	TRIMBLE	421	SUPERPAVE 3/8"	PG70-28	2	9/3/98									
Sublot 1							6.2	2.461	4.2	15.5	147.1	140.4	9/4/98	0.063	52
Sublot 2															
Sublot 3															
Sublot 4															

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 112 0421 000-007	TRIMBLE	421	SUPERPAVE 1/2"	PG70-28	1	8/19/98									
Sublot 1							5.4	2.470	3.6	14.2	148.8	144.5	8/21/98	0.063	114
Sublot 2							5.1	2.494	6.3	15.6	146.0	144.6	8/24/98	0.063	114
Sublot 3							5.6	2.465	4.5	15.3	147.2	145.1	8/24/98	0.063	114
Sublot 4							5.5	2.472	3.5	14.2	149.0	145.5	8/25/98	0.063	114

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 112 0421 000-007	TRIMBLE	421	SUPERPAVE 1/2"	PG70-28	2	8/25/98									
Sublot 1							5.6	2.476	3.8	14.4	148.8	145.2	8/25/98	0.063	114
Sublot 2							5.9	2.467	3.2	14.3	149.3	146.2	8/26/98	0.063	114
Sublot 3							5.3	2.473	4.1	14.3	148.3	145.6	8/27/98	0.063	114
Sublot 4							5.8	2.461	3.1	14.3	149.0	143.1	8/27/98	0.063	114

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 112 0421 000-007	TRIMBLE	421	SUPERPAVE 1/2"	PG70-28	3	8/27/98									
Sublot 1							5.1	2.480	6.5	16.1	144.9	143.3	8/31/98	0.063	114
Sublot 2							5.5	2.468	3.7	14.4	148.5	143.2	8/31/98	0.063	114
Sublot 3															
Sublot 4															

DISTRICT 6

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
IMSTPR 75-7(110)168	BOONE	75	SUPERPAVE 1"	PG64-22	1	8/27/98-10/9/98									
Sublot 1							4.0	2.559	4.7	12.4	152.4	148	10/4/98		NO DATA
Sublot 2							4.3	2.529	2.4	11.6	154.4	148	10/6/98		NO DATA
Sublot 3							3.9	2.544	3.0	11.3	154.3	148.2	10/9/98		NO DATA
Sublot 4							3.8	2.550	3.2	11.1	154.3	147.0	10/9/98		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
IMSTPR 75-7(110)168	BOONE	75	SUPERPAVE 1"	PG64-22	2	10/10/98									
Sublot 1							4.0	2.544	3.2	11.6	154.0	146.2	10/10/98		NO DATA
Sublot 2							3.7	2.535	3.0	11.4	153.8	146.1	12/10/98		NO DATA
Sublot 3							3.7	2.556	4.1	11.7	153.2	144.7	12/10/98		NO DATA
Sublot 4							3.7	2.550	4.3	12.1	152.4	144.9	12/11/98		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 059 0016 003-010	KENTON	16	SUPERPAVE 3/8"	PG64-22	1	10/24-29/98									
Sublot 1							5.3	2.495	3.2	13.7	151.0	..	..	0.081	NO DATA
Sublot 2							5.3	2.498	4.7	15.0	148.8	145.8	..	0.081	NO DATA
Sublot 3							5.3	2.506	4.4	14.5	149.7	145.9	..	0.081	NO DATA
Sublot 4							5.3	2.506	3.9	14.0	150.6	146.2	..	0.081	NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 059 0016 003-010	KENTON	16	SUPERPAVE 3/8"	PG64-22	2	11/2-4/98									
Sublot 1							5.3	2.499	2.7	13.1	152.3	142.5	..	0.081	NO DATA
Sublot 2															NO DATA
Sublot 3															NO DATA
Sublot 4															NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD06 019 0027 010-016	CAMPBELL	27	SUPERPAVE 1"	PG70-22	1	10/1/98									
Sublot 1							4.0	2.538	4.1	12.5	152.1	..	..	0.063	84
Sublot 2							4.0	2.546	5.5	13.5	150.4	143.75	10/5/98	0.063	84
Sublot 3							4.0	2.549	3.6	11.6	151.6	144.90	10/5/98	0.063	84
Sublot 4							4.0	2.541	4.2	12.4	151.2	145.38	10/5/98	0.063	84

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD06 019 0027 010-016	CAMPBELL	27	SUPERPAVE 1"	PG70-22	2	10/2/98									
Sublot 1							4.0	2.543	4.9	13.2	151.2	145.0	..	0.063	84
Sublot 2							4.1	2.537	4.1	12.7	152.6	145.6	..	0.063	84
Sublot 3							4.1	2.541	4.4	12.8	152.5	145.6	..	0.063	84
Sublot 4							4.0	2.534	4.0	12.6	152.6	146.8	..	0.063	84

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD06 019 0027 010-016	CAMPBELL	27	SUPERPAVE 1"	PG70-22	3	10/2/98									
Sublot 1							4.1	2.550	4.9	13.0	151.6	147.0	10/8/98	0.063	84
Sublot 2							4.1	2.547	4.4	12.7	152.2	147.3	10/8/98	0.063	84
Sublot 3							4.1	2.540	4.1	12.6	152.2	145.8	10/8/98	0.063	84
Sublot 4							4.1	2.547	4.0	12.2	152.9	147.3	10/12/98	0.063	84

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD06 019 0027 010-016	CAMPBELL	27	SUPERPAVE 3/8"	PG70-22	1	10/14-16/98									
Sublot 1							5.9	2.486	3.6	15.3	149.8	..	..	0.063	84
Sublot 2							5.9	2.490	2.7	14.4	152.2	143.5	..	0.063	84
Sublot 3							5.8	2.488	3.6	15.1	149.9	143.9	..	0.063	84
Sublot 4							6.0	2.490	3.3	15.0	150.5	143.2	..	0.063	84

DISTRICT 7

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 GR98 0000007	FAYETTE	NEW CIRCLE	SUPERPAVE 3/8"	PG76-22	2	7/8-18/98									
Sublot 1							5.9	2.491	3.6	14.8	151.1	145	7/10/98	0.063	90
Sublot 2							5.8	2.487	4.2	15.4	148.9	145.18	7/11/98	0.063	90
Sublot 3							5.9	2.488	3.7	15.0	149.8	146.50	7/19/98	0.063	90
Sublot 4							5.9	2.482	4.2	15.7	148.6	146.50	7/20/98	0.063	90

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 GR98 0000007	FAYETTE	NEW CIRCLE	SUPERPAVE 3/8"	PG76-22	3	7/19-21/98									
Sublot 1							5.8	2.480	4.3	15.7	148.3	144.125	7/19/98	0.063	90
Sublot 2							5.9	2.484	4.1	15.5	149.0	142.40	7/21/98	0.063	90
Sublot 3							5.9	2.485	4.1	15.5	148.8	143.75	7/21/98	0.063	90
Sublot 4							5.8	2.490	3.3	14.5	150.4	142.90	7/22/98	0.063	90

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 GR98 0000007	FAYETTE	NEW CIRCLE	SUPERPAVE 3/8"	PG76-22	4	7/21/98									
Sublot 1							5.8	2.487	4.4	15.6	148.6	140.6	7/23/98	0.063	90
Sublot 2															
Sublot 3															
Sublot 4															

DISTRICT 8

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 069 0078 002-012	LINCOLN	78	SUPERPAVE 3/8"	PG64-22	1	9/8/98									
Sublot 1							5.8	2.490	3.2	14.9	157.0	144.3	9/3/98	0.065	NO DATA
Sublot 2							6.0	2.488	3.4	15.3	150.2	145.4	9/4/98	0.065	NO DATA
Sublot 3							5.9	2.492	4.0	15.4	149.2	146.1	9/8/98	0.065	NO DATA
Sublot 4							5.3	2.508	4.8	15.1	148.9	146.5	9/8/98	0.065	NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 069 0078 002-012	LINCOLN	78	SUPERPAVE 3/8"	PG64-22	2	9/9/98									
Sublot 1							5.6	2.499	4.2	15.2	149.6	145.7	9/3/98	0.065	NO DATA
Sublot 2							5.3	2.505	4.5	15.0	149.5	145.6	9/4/98	0.065	NO DATA
Sublot 3							5.7	2.493	3.8	15.1	149.9	145.6	9/8/98	0.065	NO DATA
Sublot 4															NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-013	PULASKI	27	SUPERPAVE 1"	PG64-22	1	7/15-16/98									
Sublot 1							3.8	2.538	3.4	12.0	153.4	..	..		NO DATA
Sublot 2							3.9	2.536	4.3	12.9	153.2	152.30	7/17/98		NO DATA
Sublot 3							3.7	2.540	4.0	12.4	153.6	152.56	7/17/98		NO DATA
Sublot 4							4.1	2.528	3.2	12.4	153.9	150.90	7/17/98		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-013	PULASKI	27	SUPERPAVE 1"	PG64-22	2	7/23-8/27/98									
Sublot 1							3.9	2.533	3.7	12.6	152.5	150.9	..		NO DATA
Sublot 2							3.8	2.537	4.0	12.6	152.3	149.8	..		NO DATA
Sublot 3							3.5	2.548	4.8	12.7	151.4	149.5	..		NO DATA
Sublot 4							3.7	2.540	4.7	13.1	151.0	149.1	..		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-013	PULASKI	27	SUPERPAVE 1"	PG64-22	3	8/30-9/2/98									
Sublot 1							3.7	2.542	5.4	13.7	150.3	151.8	..		NO DATA
Sublot 2							4.0	2.531	3.8	12.8	152.3	150.7	..		NO DATA
Sublot 3							3.9	2.532	4.2	13.1	151.6	150.2	..		NO DATA
Sublot 4							3.4	2.552	5.4	13.1	150.8	151.1	..		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-013	PULASKI	27	SUPERPAVE 1"	PG64-22	4	9/2-30/98									
Sublot 1							3.5	2.549	5.1	12.9	151.3	149.8	..		NO DATA
Sublot 2							3.8	2.537	4.5	13.2	151.3	152.6	..		NO DATA
Sublot 3							3.6	2.544	4.4	12.6	152.0	151.9	..		NO DATA
Sublot 4							3.5	2.548	5.5	13.5	150.4	152.4	..		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-013	PULASKI	27	SUPERPAVE 1"	PG64-22	5	10/1-11/18									
Sublot 1							3.8	2.538	4.6	13.1	151.3	151.2	..		NO DATA
Sublot 2							3.9	2.536	3.8	12.6	152.4	150.3	..		NO DATA
Sublot 3							4.0	2.531	4.7	13.7	150.8	150.2	..		NO DATA
Sublot 4							4.0	2.530	4.3	13.4	151.3	150.3	..		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-013	PULASKI	27	SUPERPAVE 1"	PG64-22	6	9/15/98									
Sublot 1							3.4	2.554	5.5	13.1	150.8	150.2	..		NO DATA
Sublot 2							3.8	2.540	5.0	13.4	150.8	150.2	..		NO DATA
Sublot 3							3.8	2.537	4.3	13.0	150.9	150.0	..		NO DATA
Sublot 4							3.9	2.535	4.1	12.9	150.8	150.8	..		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 0011-016	PULASKI	27	SUPERPAVE 1"	PG76-22	1	9/7-9/8/98									
Sublot 1							4.1	2.537	5.6	14.4	149.6		9/8/98		NO DATA
Sublot 2							4.4	2.525	4.0	13.6	151.5	150.3	9/8/98		NO DATA
Sublot 3							4.0	2.537	4.9	13.7	150.8	150.0	9/9/98		NO DATA
Sublot 4							4.0	2.539	5.0	13.7	150.7	150.2	9/9/98		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 0011-016	PULASKI	27	SUPERPAVE 1"	PG76-22	2	9/9 -9/10/98									
Sublot 1							3.9	2.544	4.1	12.5	152.5	150.7	9/10/98		NO DATA
Sublot 2							3.9	2.541	4.5	13.1	151.6	151.6	9/10/98		NO DATA
Sublot 3							4.2	2.530	4.1	13.3	151.7	150.9	9/10/98		NO DATA
Sublot 4							4.0	2.540	4.2	12.9	152.0	152.3	9/11/98		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 0011-016	PULASKI	27	SUPERPAVE 1"	PG76-22	3	9/16-9/23/98									
Sublot 1							4.3	2.528	4.0	13.4	151.6	151.9	..		NO DATA
Sublot 2							3.9	2.541	5.0	13.5	150.8	150.7	..		NO DATA
Sublot 3							4.0	2.538	4.9	13.6	150.9	150.4	..		NO DATA
Sublot 4							4.4	2.523	4.7	14.3	150.3	150.4	..		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 0011-016	PULASKI	27	SUPERPAVE 1"	PG76-22	4	10/12-15/98									
Sublot 1							4.1	2.536	4.6	13.5	151.1	151.0	..		NO DATA
Sublot 2							4.1	2.535	4.5	13.4	151.4	150.9	..		NO DATA
Sublot 3							4.2	2.533	5.1	14.1	150.3	150.2	..		NO DATA
Sublot 4							4.3	2.528	4.5	13.8	150.9	150.4	..		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 0011-016	PULASKI	27	SUPERPAVE 1"	PG76-22	5	10/15-27/98									
Sublot 1							4.2	2.533	4.4	13.5	151.3	149.9	..		NO DATA
Sublot 2							4.2	2.531	5.1	14.2	150.1	150.6	..		NO DATA
Sublot 3							4.0	2.537	4.7	13.5	151.2	151.2	..		NO DATA
Sublot 4							4.3	2.525	4.5	14.0	150.8	149.1	..		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 0011-016	PULASKI	27	SUPERPAVE 1"	PG76-22	6	10/28/98									
Sublot 1							4.1	2.535	4.7	13.6	151.0	149.2	..		NO DATA
Sublot 2															NO DATA
Sublot 3															NO DATA
Sublot 4															NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-013	PULASKI	27	SUPERPAVE 1"	PG76-22	1	9/16/98									
Sublot 1							4.1	2.536	4.4	13.3	151.4	152.0	..		NO DATA
Sublot 2							4.0	2.538	4.6	13.4	151.3	152.0	..		NO DATA
Sublot 3							4.1	2.533	4.7	13.7	151.1	151.2	..		NO DATA
Sublot 4							4.1	2.535	4.7	13.7	151.1	152.3	..		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf0	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-013	PULASKI	27	SUPERPAVE 1"	PG76-22	2	9/21-10/13/98									
Sublot 1							4.0	2.539	4.3	13.0	151.8	150.4	..		NO DATA
Sublot 2							4.2	2.533	4.3	13.3	151.6	151.3	..		NO DATA
Sublot 3							4.3	2.528	3.9	13.3	151.8	151.5	..		NO DATA
Sublot 4							4.1	2.534	5.2	14.1	150.2	151.2	..		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-013	PULASKI	27	SUPERPAVE 1"	PG76-22	3	10/13-19/98									
Sublot 1							4.2	2.531	5.5	14.6	149.5	151.6	..		NO DATA
Sublot 2							4.3	2.526	5.0	14.4	150.0	151.2	..		NO DATA
Sublot 3							4.0	2.537	5.3	14.0	150.3	151.4	..		NO DATA
Sublot 4															NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-016	PULASKI	27	SUPERPAVE 1"	PG64-22	2	6/11/98									
Sublot 1							3.8	2.540	3.8	12.3	152.6	152.2	..		NO DATA
Sublot 2							3.8	2.537	3.9	12.1	152.4	152.40	..		NO DATA
Sublot 3							3.8	2.540	4.1	12.6	152.2	151.60	..		NO DATA
Sublot 4							3.8	2.529	4.1	13.0	151.5	152.00	..		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-016	PULASKI	27	SUPERPAVE 1"	PG64-22	3	8/11-24/98									
Sublot 1							3.8	2.536	4.5	13.0	151.4	151.2	..		NO DATA
Sublot 2							3.8	2.545	5.2	13.4	150.8	150.20	..		NO DATA
Sublot 3							3.8	2.532	4.6	13.3	150.9	150.90	..		NO DATA
Sublot 4							3.8	2.535	4.1	12.8	151.9	152.30	..		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf0	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-016	PULASKI	27	SUPERPAVE 1"	PG64-22	4	8/25/98									
Sublot 1							4.1	2.527	4.7	13.8	150.6	152.4	8/25/98		NO DATA
Sublot 2							3.8	2.536	4.5	13.2	151.3	150.7	8/25/98		NO DATA
Sublot 3							3.6	2.545	4.8	12.9	151.4	149.3	8/26/98		NO DATA
Sublot 4							3.6	2.545	5.0	13.1	151.0	150.1	8/26/98		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-016	PULASKI	27	SUPERPAVE 1"	PG64-22	5	8/27/98									
Sublot 1							4.1	2.525	4.2	13.6	151.1	149.2	8/28/98		NO DATA
Sublot 2							3.9	2.535	5.0	13.7	150.5	149.0	8/31/98		NO DATA
Sublot 3							4.1	2.525	4.3	13.6	151.0	150.2	8/31/98		NO DATA
Sublot 4							3.9	2.533	4.3	13.2	151.5	150.0	9/15/98		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-016	PULASKI	27	SUPERPAVE 1"	PG64-22	6	9/15/98									
Sublot 1							3.4	2.554	5.5	13.1	150.8	149.1	..		NO DATA
Sublot 2							3.8	2.540	5.0	13.4	150.8	149.5	..		NO DATA
Sublot 3							3.8	2.537	4.3	13.0	151.6	150.3	..		NO DATA
Sublot 4							3.9	2.535	4.1	12.9	151.9	150.3	..		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-016	PULASKI	27	SUPERPAVE 1"	PG64-22	7	10/4-6/98									
Sublot 1							3.6	2.547	4.7	12.8	151.6	151.1	..		NO DATA
Sublot 2							3.7	2.543	4.4	12.7	151.8	150.2	..		NO DATA
Sublot 3							3.8	2.537	4.0	12.6	152.3	151.1	..		NO DATA
Sublot 4							3.9	2.535	4.3	13.1	151.6	152.0	..		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-016	PULASKI	27	SUPERPAVE 1"	PG64-22	8	10/6/98									
Sublot 1							3.8	2.538	4.1	12.7	152.1	149.8	..		NO DATA
Sublot 2							3.7	2.541	5.0	13.4	150.8	149.9	..		NO DATA
Sublot 3							3.8	2.538	4.4	13.0	151.6	151.0	..		NO DATA
Sublot 4							3.7	2.541	4.8	13.2	151.1	150.6	..		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-016	PULASKI	27	SUPERPAVE 1"	PG64-22	9	10/21-31/98									
Sublot 1							3.8	2.539	4.2	12.7	152.0	150.2	..		NO DATA
Sublot 2							4.0	2.530	4.0	13.1	151.8	151.2	..		NO DATA
Sublot 3							3.8	2.532	5.0	13.9	150.3	150.1	..		NO DATA
Sublot 4							4.0	2.532	4.7	13.6	150.8	149.6	..		NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD04 100 0027 011-016	PULASKI	27	SUPERPAVE 1"	PG64-22	10	11/12-23/98									
Sublot 1							3.9	2.534	4.7	13.5	150.8	149.4	..		NO DATA
Sublot 2							3.7	2.541	4.3	12.7	152.0	147.6	..		NO DATA
Sublot 3							3.9	2.535	4.0	12.8	152.1	147.6	..		NO DATA
Sublot 4							4.1	2.528	4.5	13.6	151.0	146.7	..		NO DATA

DISTRICT 9

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 081 GR98 0000081	MASON	9	SUPERPAVE 1/2"	PG76-22	1	9/17/98									
Sublot 1							5.7	2.468	5.4	16.2	145.8	146.5	9/17/98	0.079	48
Sublot 2							5.7	2.472	4.1	14.9	148.3	148.0	9/21/98	0.079	48
Sublot 3							5.7	2.480	3.4	14.1	149.6	145.6	9/25/98	0.079	48
Sublot 4							5.5	2.490	3.5	13.6	150.1	145.0	9/25/98	0.079	48

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 081 GR98 0000081	MASON	9	SUPERPAVE 1/2"	PG76-22	2	9/23-29/98									
Sublot 1							5.5	2.481	3.9	14.3	149.0	145.7	9/25/98	0.079	48
Sublot 2							5.5	2.480	5.8	16.0	146.0	143.7	9/29/98	0.079	48
Sublot 3							5.7	2.473	4.4	15.1	147.8	146.0	9/29/98	0.079	48
Sublot 4							5.7	2.471	4.2	15.0	147.9	146.1	9/30/98	0.079	48

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 081 GR98 0000081	MASON	9	SUPERPAVE 1/2"	PG76-22	3	9/30/98									
Sublot 1							5.7	2.471	4.2	15.0	147.9	146.2	9/30/98	0.079	48
Sublot 2															
Sublot 3															
Sublot 4															

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 010 0023 003-011	BOYD	23	SUPERPAVE 1/2"	PG76-22	1	10/1-3/98									
Sublot 1							5.9	2.463	2.6	14.1	149.9	145.2	10/4/98	0.07	NO DATA
Sublot 2							5.7	2.488	3.9	14.1	149.4	146.2	10/4/98	0.07	NO DATA
Sublot 3							5.7	2.459	4.3	15.5	147.0	141.8	10/4/98	0.07	NO DATA
Sublot 4							5.7	2.449	3.4	14.9	147.9	143.5	10/4/98	0.07	NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 010 0023 003-011	BOYD	23	SUPERPAVE 1/2"	PG76-22	2	10/5/98									
Sublot 1							5.7	2.448	4.1	15.6	146.8	143.7	10/5/98	0.07	NO DATA
Sublot 2							5.7	2.464	4.1	15.0	147.6	143.6	10/5/98	0.07	NO DATA
Sublot 3							5.7	2.446	3.4	15.0	147.8	143.9	10/6/98	0.07	NO DATA
Sublot 4							5.7	2.452	3.8	15.1	147.4	144.1	10/6/98	0.07	NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	MaxSpec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 010 0023 003-011	BOYD	23	SUPERPAVE 1/2"	PG76-22	3	10/6-9/98									
Sublot 1							5.7	2.456	4.1	15.3	147.1	143.4	10/6/98	0.07	NO DATA
Sublot 2							5.6	2.455	4.0	15.0	147.4	141.8	10/7/98	0.07	NO DATA
Sublot 3							5.7	2.462	3.8	14.8	147.9	143.8	10/9/98	0.07	NO DATA
Sublot 4							5.6	2.458	4.1	15.1	147.3	144.3	10/9/98	0.07	NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	MaxSpec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 010 0023 003-011	BOYD	23	SUPERPAVE 1/2"	PG76-22	4	10/9 -10/98									
Sublot 1							5.7	2.463	4.6	15.3	146.9	144.3	10/9/98	0.07	NO DATA
Sublot 2							5.7	2.455	4.3	15.4	146.8	142.9	10/10/98	0.07	NO DATA
Sublot 3							5.7	2.456	4.5	15.6	146.5	143.6	10/10/98	0.07	NO DATA
Sublot 4							5.6	2.443	4.4	15.9	145.9	143.7	10/10/98	0.07	NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 010 0023 003-011	BOYD	23	SUPERPAVE 1/2"	PG76-22	5	10/12-13/98									
Sublot 1							5.7	2.452	3.8	15.1	147.5	142.2	10/12/98	0.07	NO DATA
Sublot 2							5.7	2.448	4.1	14.8	146.7	142.2	10/12/98	0.07	NO DATA
Sublot 3							5.8	2.464	4.0	15.0	147.8	143.1	10/13/98	0.07	NO DATA
Sublot 4							5.5	2.459	3.5	14.5	148.3	141.8	10/13/98	0.07	NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 010 0023 003-011	BOYD	23	SUPERPAVE 1/2"	PG76-22	6	10/13/98									
Sublot 1							5.6	2.483	4.4	14.5	148.4	143.3	..	0.07	NO DATA
Sublot 2															
Sublot 3															
Sublot 4															

DISTRICT 10

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 033 0052 000-004	ESTILL	52	SUPERPAVE 3/8"	PG70-22	1	9/17-18/98									
Sublot 1							6.2	2.483	2.8	15.2	149.6	143.1	..	0.063	104
Sublot 2							6.0	2.483	3.9	15.4	149.2	144.0	..	0.063	104
Sublot 3							6.0	2.480	3.1	14.8	150.2	143.6	..	0.063	104
Sublot 4							5.9	2.478	3.6	15.2	149.3	144.1	..	0.063	104

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 033 0052 000-004	ESTILL	52	SUPERPAVE 3/8"	PG70-22	2	9/18/98									
Sublot 1							6.0	2.478	3.6	15.2	149.4	143.8	9/21/98	0.063	104
Sublot 2							5.8	2.478	3.4	14.9	149.7	143.4	9/21/98	0.063	104
Sublot 3							6.0	2.479	3.0	14.7	150.3	146.0	9/23/98	0.063	104
Sublot 4															

DISTRICT 11

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 007 025E 006-012	BELL	25E	SUPERPAVE 1/2"	PG76-22	1	7/30/98									
Sublot 1							5.5	2.512	3.0	14.5	152.3	145.8	7/31/98	0.066	NO DATA
Sublot 2							5.4	2.512	3.6	15.1	151.3	146.9	8/3/98	0.066	NO DATA
Sublot 3							5.2	2.520	4.6	15.5	150.2	146.3	8/3/98	0.066	NO DATA
Sublot 4							5.6	2.507	3.2	14.9	151.8	147.0	8/4/98.	0.066	NO DATA

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (pcf)	Compactive Effort
FD05 007 025E 006-012	BELL	25E	SUPERPAVE 1/2"	PG76-22	2	8/4/98									
Sublot 1							5.3	2.520	2.8	14.0	153.1	146.8	..	0.066	NO DATA
Sublot 2							5.1	2.514	3.5	14.6	151.6	148.7	..	0.066	NO DATA
Sublot 3							5.3	2.518	3.1	14.2	152.5	148.4	..	0.066	NO DATA
Sublot 4															

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 061 025E 014-022	KNOX	25E	SUPERPAVE 1/2"	PG 76-22	1	8/19/98									
Sublot 1							5.3	2.505	3.8	14.2	150.6	145.2	..	0.063	112
Sublot 2							5.4	2.507	3.7	14.2	150.9	146.2	..	0.063	112
Sublot 3							5.7	2.498	3.6	14.6	150.6	145.7	..	0.063	112
Sublot 4							5.6	2.501	3.0	14.0	151.6	142.7	..	0.063	112

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 061 025E 014-022	KNOX	25E	SUPERPAVE 1/2"	PG 76-22	2	8/20/98									
Sublot 1							5.4	2.507	3.4	14.0	151.3	145.9	..	0.063	112
Sublot 2							5.6	2.499	3.1	14.2	151.3	145.0	..	0.063	112
Sublot 3							5.6	2.502	2.8	13.7	151.9	144.5	..	0.063	112
Sublot 4							5.4	.2.507	3.4	14.0	151.3	146.3	..	0.063	112

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 061 025E 014-022	KNOX	25E	SUPERPAVE 1/2"	PG 76-22	3	8/28/98									
Sublot 1							5.5	2.489	3.3	15.0	150.9	143.5	8/28/98	0.063	112
Sublot 2							5.7	2.504	3.0	14.7	151.8	144.4	8/29/98	0.063	112
Sublot 3							5.5	2.505	3.0	14.5	151.8	145.2	8/31/98	0.063	112
Sublot 4							5.2	2.509	3.1	14.2	151.9	143.7	..	0.063	112

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 061 025E 014-022	KNOX	25E	SUPERPAVE 1/2"	PG 76-22	4	8/31/98									
Sublot 1							5.1	2.518	3.4	14.1	151.9	144.4	..	0.063	112
Sublot 2							5.3	2.503	4.7	15.8	149.2	144.5	..	0.063	112
Sublot 3							5.0	2.522	4.3	14.6	150.8	147.2	..	0.063	112
Sublot 4							5.6	2.491	3.5	15.4	150.3	144.7	..	0.063	112

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 061 025E 014-022	KNOX	25E	SUPERPAVE 1/2"	PG 76-22	5	9/8/98									
Sublot 1							5.8	2.486	3.7	16.0	149.6	146.6	..	0.063	112
Sublot 2							5.3	2.511	3.8	14.8	150.8	146.9	..	0.063	112
Sublot 3							5.2	2.515	3.9	14.7	151.1	146.2	..	0.063	112
Sublot 4															

DISTRICT 12

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD39 098 0023 006-015	PIKE	23	SUPERPAVE 3/8"	PG76-22	1	10/12-13/98									
Sublot 1							6.0	2.478	3.5	14.7	149.4	145.4	10/14/98	0.069	
Sublot 2							6.0	2.484	3.8	14.8	149.3	144.20	10/14/98	0.069	
Sublot 3							6.0	2.470	4.4	15.8	147.6	143.75	10/14/98	0.069	
Sublot 4							6.0	2.482	4.4	15.4	148.3	143.70	10/14/98	0.069	

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD39 098 0023 006-015	PIKE	23	SUPERPAVE 3/8"	PG76-22	2	10/13/98									
Sublot 1							6.0	2.476	4.3	15.5	148.2	143.7	10/14/98	0.069	
Sublot 2							6.0	2.472	4.1	15.5	148.2	143.9	10/15/98	0.069	
Sublot 3							6.0	2.472	3.2	14.7	149.6	144.2	10/15/98	0.069	
Sublot 4							6.0	2.476	4.6	15.8	147.6	144.1	10/15/98	0.069	

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD39 098 0023 006-015	PIKE	23	SUPERPAVE 3/8"	PG76-22	3	10/15/98									
Sublot 1							6.0	2.469	3.8	15.3	148.5	144.5	10/17/98	0.069	
Sublot 2							6.0	2.475	4.2	15.4	148.3	144.6	10/17/98	0.069	
Sublot 3							6.0	2.471	4.5	15.8	147.5	144.5	10/17/98	0.069	
Sublot 4															

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 060 550 004-010	KNOTT	550	SUPERPAVE 1/2"	PG76-22	1	9/2-4/98									
Sublot 1							5.7	2.488	5.2	17.3	147.4	143.8	..	0.07	72
Sublot 2							5.6	2.492	4.8	16.7	148.0	143.1	..	0.07	72
Sublot 3							5.6	2.491	3.4	15.5	150.4	143.6	..	0.07	72
Sublot 4							5.8	2.493	2.9	15.1	151.3	143.7	..	0.07	72

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD05 060 550 004-010	KNOTT	550	SUPERPAVE 1/2"	PG76-22	2	9/4-8/98									
Sublot 1							5.6	2.492	4.5	16.4	148.8	143.75	..	0.07	72
Sublot 2							5.7	2.491	4.4	16.4	148.8	144.40	..	0.07	72
Sublot 3							5.7	2.489	4.2	16.4	148.9	144.10	..	0.07	72
Sublot 4															

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD39 098 0023 006-015	PIKE	23	SUPERPAVE 3/8"	PG76-22	1	10/12/98									

							% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
Sublot 1							5.9	2.466	4.5	16.3	147.2	145.7	10/14/98	0.069	
Sublot 2							6.0	2.471	4.4	16.2	147.6	145.3	10/14/98	0.069	
Sublot 3							6.0	2.453	4.9	17.3	145.8	143.8	10/14/98	0.069	
Sublot 4							6.0	2.458	4.4	16.8	146.8	144.4	10/14/98	0.069	

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD39 098 0023 006-015	PIKE	23	SUPERPAVE 3/8"	PG76-22	2	10/15/98									
Sublot 1							6.1	2.455	4.5	17.0	146.6	144.3	10/16/98	0.069	
Sublot 2							6.0	2.448	4.0	16.6	146.9	145.2	10/16/98	0.069	
Sublot 3							5.9	2.452	4.4	16.6	146.4	144.6	10/19/98	0.069	
Sublot 4							6.0	2.452	4.3	17.0	146.6	145.7	10/19/98	0.069	

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD39 098 0023 006-015	PIKE	23	SUPERPAVE 3/8"	PG76-22	3	10/16/98									
Sublot 1							6.0	2.452	4.3	16.6	146.6	146	...	0.069	
Sublot 2															
Sublot 3															
Sublot 4															

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD39 098 0023 006-015	PIKE	23	SUPERPAVE 1.5"	PG76-22	2	7/29/98									
Sublot 1							4.0	2.537	4.6	13.1	151.3	148.9	..	0.069	
Sublot 2							4.2	2.532	4.8	13.8	150.8	150.3	..	0.069	
Sublot 3							4.2	2.531	4.2	13.4	151.6	150.0	..	0.069	
Sublot 4							3.9	2.541	3.9	12.5	152.6	149.6	..	0.069	

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD39 098 0023 006-015	PIKE	23	SUPERPAVE 1.5"	PG76-22	3	9/8/98									
Sublot 1							4.0	2.529	4.5	13.5	150.9	149.2	9/9/98	0.069	
Sublot 2							4.0	2.529	3.2	12.3	153.0	146.6	9/19/98	0.069	
Sublot 3							4.0	2.543	4.5	13.0	151.8	149.7	9/21/98	0.069	
Sublot 4							4.0	2.536	3.6	12.5	152.8	150.4	9/21/98	0.069	

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	Avg Core Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD39 098 0023 006-015	PIKE	23	SUPERPAVE 1.5"	PG76-22	4	9/17/98									
Sublot 1							4.0	2.542	3.5	12.1	153.4	147.2	9/21/98	0.069	
Sublot 2							4.0	2.550	4.2	12.6	152.6	146.7	9/22/98	0.069	

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
Sublot 3							4.0	2.527	3.6	12.8	152.3	150.8	9/23/98	0.069	
Sublot 4							4.0	2.533	4.0	13.0	151.9	150.2	9/23/98	0.069	

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD39 098 0023 006-015	PIKE	23	SUPERPAVE 1.5"	PG76-22	5	9/19/98									
Sublot 1							4.0	2.524	3.0	12.4	153.0	147.9	9/21/98	0.069	
Sublot 2							4.0	2.531	3.6	12.6	152.6	148.2	9/21/98	0.069	
Sublot 3							4.0	2.536	3.8	12.6	152.5	147.6	9/23/98	0.069	
Sublot 4							4.0	2.537	3.5	12.3	153.0	146.9	9/23/98	0.069	

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	% AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD39 098 0023 006-015	PIKE	23	SUPERPAVE 1.5"	PG76-22	6	9/22/98									
Sublot 1							4.0	2.539	3.7	12.5	152.7	149.6	9/23/98	0.069	
Sublot 2							4.0	2.534	4.1	13.0	151.8	149.0	9/23/98	0.069	
Sublot 3							4.0	2.535	3.0	11.9	153.7	148.9	9/24/98	0.069	
Sublot 4							4.0	2.540	4.2	12.9	152.1	149.1	9/24/98	0.069	

Project Number	County	Road Name	Type Mix	Binder Grade	Lot Number	Date Paved	%AC Mix	Max Spec Gravity	%AV Mix	%VMA Mix	Design Mix Density (pcf)	AvgCore Density (pcf)	Core Date	Rutting Avg (in.)	Compactive Effort
FD39 098 0023 006-015	PIKE	23	SUPERPAVE 1.5"	PG76-22	7	9/24/98									
Sublot 1							4.0	2.535	3.6	12.5	152.8	148.4	9/26/98	0.069	
Sublot 2							4.0	2.531	3.4	12.5	152.8	149.2	9/26/98	0.069	
Sublot 3							4.0	2.531	4.2	13.2	151.6	148.2	9/26/98	0.069	
Sublot 4							4.0	2.533	4.0	13.0	151.9	148.6	9/28/98	0.069	